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What Ford Has Done in the Lincoln Plant

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Editor, *American Machinist*

The first of three articles giving details of some of the methods used by the Ford management to build a better car at less cost

ALTHOUGH we have been boasting of accurate work and interchangeable manufacture for many years, the notion lingers that really fine machinery cannot be built by large scale production methods. There is still a feeling, even among engineers who ought to know better, that the really fine automobile, for example, has to be built a few at a time, so that each car receives some special attention in the way of fitting its various parts. Few seem to realize that the machine that is built by thousands has to be made up of accurately machined parts before assembly can go on like clock work.

We owe much to Henry M. Leland, always noted as an excellent workman, for demonstrating that a high grade car can be *manufactured* instead of being built a few at a time. His work in developing the Cadillac car on a large production basis stands out as an achievement of which we may all be proud. The assembly of Cadillac cars from parts selected at random at a London automobile show some years ago, proved that he had the knowledge and the skill to secure results which many had considered impossible.

There were some misgivings on the part of those unfamiliar with what accurate large scale production really means, as to the quality which Mr. Leland put into the Lincoln car being maintained when it was taken over by the Ford Motor Co. For it is evidently not easy for the average man to realize that low costs do not necessarily mean cheap material and poor fits. Those who really knew the Ford organization had no fears whatever as to its ability to produce any grade of workmanship desired. A recent critical examination of the Lincoln plant proved beyond question that not only has quality been maintained but that many refinements and improvements have been added. For just as it is Mr. Ford's ambition to produce the lowest priced medium of transportation in the humble "flivver," so it is his aim to make the Lincoln the last word in mechanical perfection and comfort. And his great organization gives many advantages as to the purchase of materials and the placing of the cars in the hands of their users.

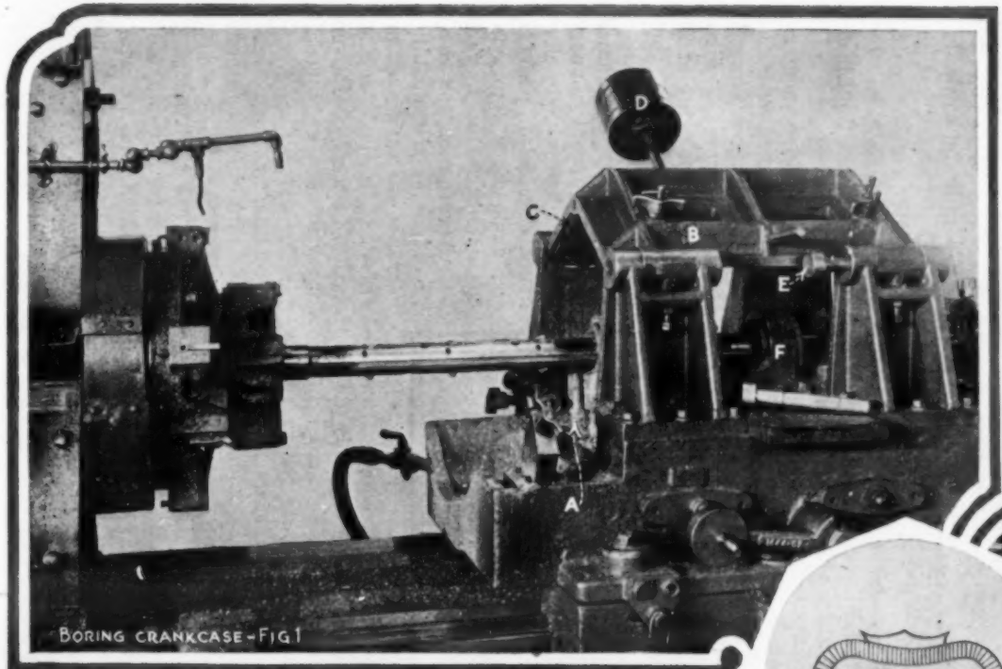
"WHAT will Ford do to the Lincoln car?" has been asked dozens of times. Even engineers, who know that modern machining methods produce accurate and interchangeable work, cannot quite see how the organization which builds the lowest-priced car in the world can at the same time produce a car of the highest grade. One reason is that it is difficult to associate good work with low costs, and how good the work on a low priced product really may be, is not appreciated.

This article and the ones to follow will point out a few of the methods that have made the Lincoln car what it is, and how refinements not only are being maintained but added to and improved in numerous ways, by the Ford organization. You'll find much of interest.

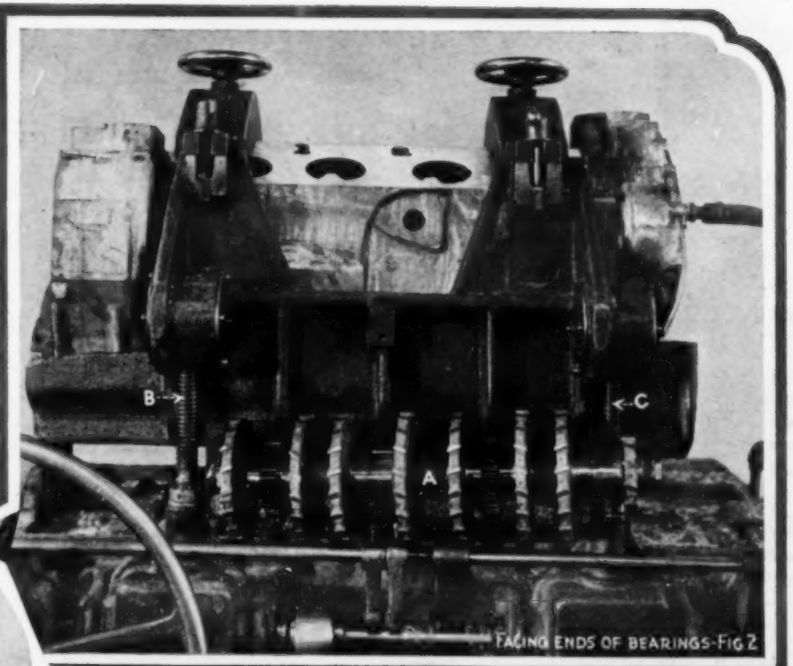
Because of this organization the present management has been able to effect many economies, while at the same time improving the quality. Due to thorough reorganization and placing of responsibility nearer to the source of supply and production, and the delivery of finished parts adjacent to assembly points, there has been effected a very noticeable decrease in the number of men employed in the manufacturing and assembly departments.

Many parts formerly made outside, and on which a profit was paid, have been absorbed into the plant manufacturing departments.

Extensive additional floor space has been added to the plant, as well as additional machinery and tools, making ideal working conditions which add materially to quality results. These additional facilities made possible the taking over of all body finishing, and the performance of it under ideal conditions and strict supervision in the plant itself.

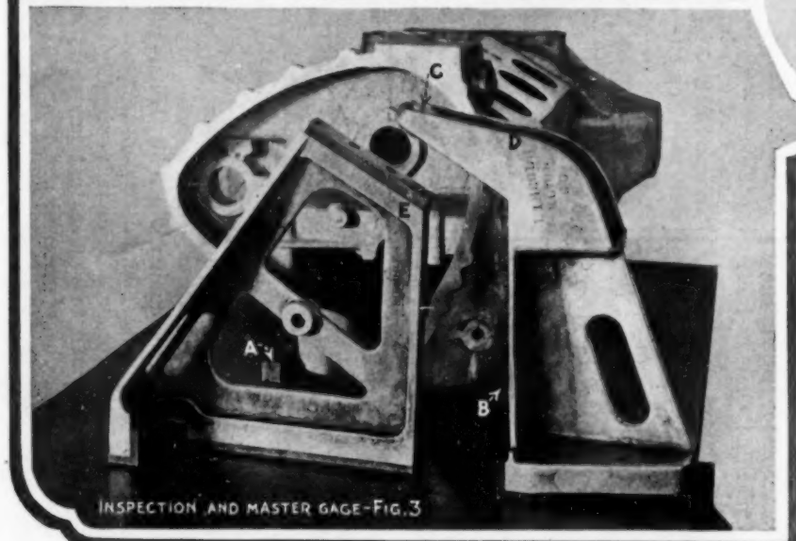


BORING CRANKCASE-FIG.1

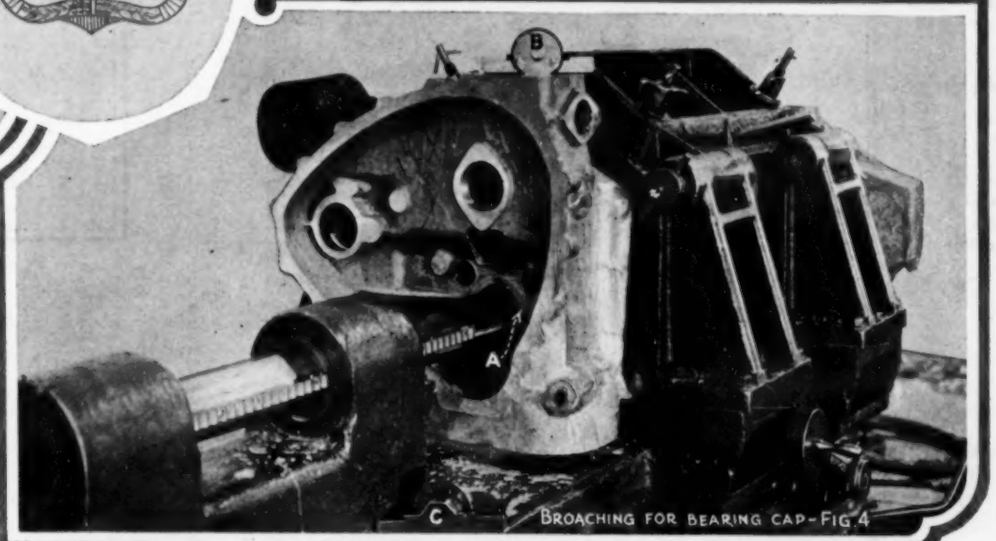


FACING ENDS OF BEARINGS-FIG.2

LINCOLN



INSPECTION AND MASTER GAGE-FIG.3



BROACHING FOR BEARING CAP-FIG.4

These changes, together with the introduction of Ford simplicity in cost, time, and stock keeping methods, have had an appreciable effect on overhead, while at the same time the production of cars has made a satisfactory increase.

As an indication of the care used in connection with the building of the Lincoln car, we may cite the testing of every frame rivet by tapping with a light hammer to note the sound. This detects any loose rivets. The ends of the frame that project are rubbed down and repainted and special care is also taken in painting the motor itself. All screws, bolts and washers that hold fenders and other parts under the car are electro-zinc plated and have brass nuts. In most places the nuts are of double thickness so that no threaded portion of the bolt or screw is ever exposed to corrosion. In other places tobin bronze screws and bolts are used so that the repair man should have much less difficulty than usual in taking down parts under the chassis.

Machining the Crankcase

It is not easy to select for illustration a few of the many operations which go to make up a large car. But with a view of showing some of the more unusual operations and the great care which is taken, both in inspection and assembly, the crankcase and transmission were selected as subjects for this first article.

The case is first machined with the exception of the boring and drilling. The camshaft and crankshaft holes are then bored, locating them from the angular cylinder-seat faces, to which they must be in proper relation. Only the crankcase half of the crankshaft bearing is bored in the fixture shown in Fig. 1. The caps are bored (one-half hole) in a separate operation. Both of these are roughing out operations but are exceedingly close approximations to an accurate location for the final axis of the finished hole.

The camshaft hole has previously been rough bored to the same close approximation of axis center line. The crankshaft-bearing caps are assembled and the case is then put into a fixture, locating it from the angular cylinder-seat faces, where both the camshaft and crankshaft bearing holes are bored at the same time with bars which have single fly tools, and which remove approximately 0.005 in. of stock. These bars produce line holes which are afterward further lined and sized with Martel reamers.

All this work is preliminary to the drilling operations and comes after the major milling operations have been completed. The case is then mounted in a fixture on pins that fit the bored and sized camshaft and crankshaft holes and located endwise from the rear bearing, which is the bearing that gives the longitudinal position to the crankshaft. All holes are now drilled while the case is held in an indexing or revolving fixture or cradle, which travels on a track and registers through hardened pins and bushings, with each successive drill jig, under which it must pass. These drill jigs are integral with the drilling machines, which are of the multi-spindle type. This method insures the exact inter-relation of all the holes from a chosen base.

The crankcase is located longitudinally by two pins on the lower face, where the oil pan goes, one of them being shown at *A*. The case is actually located and held by the cover *B* which has hardened blocks, as at *C*, fitting the cylinder-block surfaces and holding the case centrally and firmly. The cover is counter-balanced by the weight *D* and locked by pins, as at *E*.

The fixture has center bearings, as at *F*, each carrying a revolving bushing with unusually ample bearing surfaces. These bushings are provided with two slots through which the single point (fly tool) boring cutters in the bar can readily pass. A "pick-up" arrangement is provided so that these slots are automatically aligned as the bar is advanced into the boring position, bringing them into exact relation so that the driving key in the bushings is brought into exact line with the spline in the boring bar. The boring bar is driven independently of the lathe spindle which carries the boring and facing tools shown. These tools are held in a special head bolted to the faceplate on the spindle, which runs at the proper cutting speed for the larger diameters. The boring bar, however, goes through the lathe spindle and has a separate drive from the feed gearing. It runs about six times as fast as the lathe spindle and so gives a better cutting speed for its five tools. Plenty of lubricant is supplied for cutting, and the bed of the fixture acts as a pan from which the lubricant is returned to the tank by the hose shown.

A somewhat similar type of fixture is shown in Fig. 2, and is for facing the ends of the bearings with the gang of milling cutters shown in front at *A*. As the cutters are inside the case when at work, the spare set is shown in order to indicate the manner in which they are used. The cutter arbor shown is put into its bearings in the fixture and the bearing caps bolted in place. The two gears shown mesh with the driving gears below, the latter being driven by special gearing.

With the crankcase clamped in position and the cutters in place, the case is fed down onto the revolving cutters by means of the two screws shown at *B* and *C*. These screws are driven by bevel gears in the boxes below and give a positive feed for facing the inside ends of both the front and rear bearings and both sides of the three bearings inside the case.

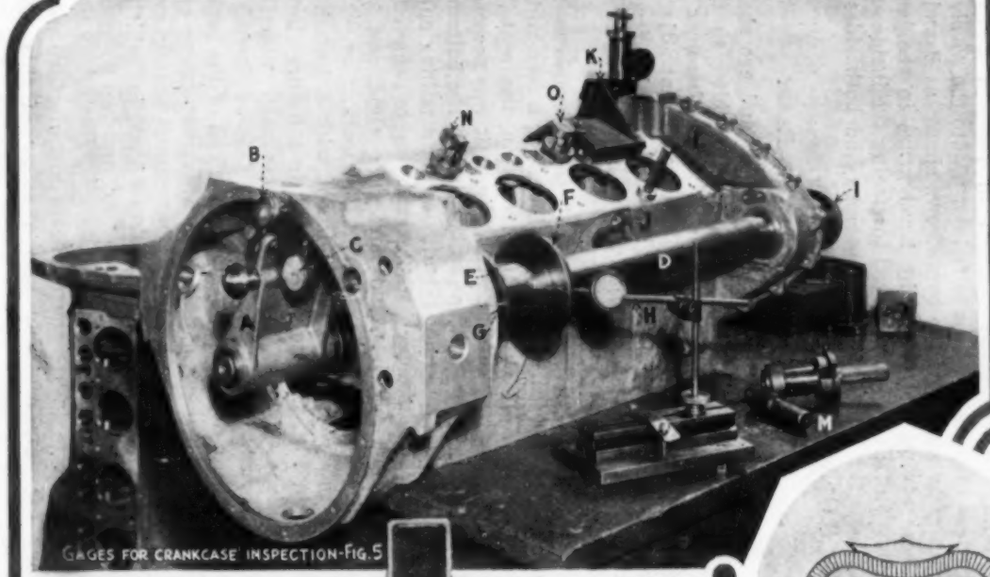
Duplicate Cutters Always Ready

The cutters are kept on their arbors and are sharpened in place. A duplicate set is provided so that there need be no delay when the set in use becomes too dull to do its best work. It will be noted that adjacent cutters of each pair have right and left rake, respectively, so as to present the proper cutting angles for obtaining the best results.

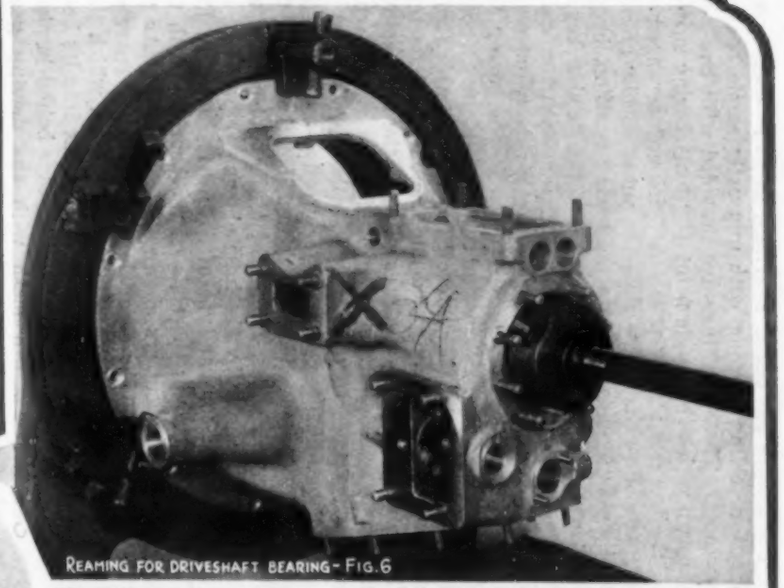
The bottoms of the bearing seats in the crankcase are milled on a vertical-spindle machine using a face-milling cutter. But for cutting the recess in the seats, in which the bearing caps fit, at *A*, Fig. 4, it was necessary to use another method, as the opening in the bottom of the crankcase would not permit driving a milling cutter of the proper diameter without resorting to some offset arrangement, which would hardly be rigid and substantial enough for rapid production work.

For this reason the recess is cut with a broach as shown in Fig. 4. The case is held in a fixture similar to those previously shown, the previously described facing operation having provided a finished surface to take the broaching thrust. The outer end of the broach is carefully guided and there is a support under each bearing so that the broaching bar cannot spring away from the cut. This method makes a good job which is held to very close limits by the "go" and "no go" gages shown at *B* and *C*.

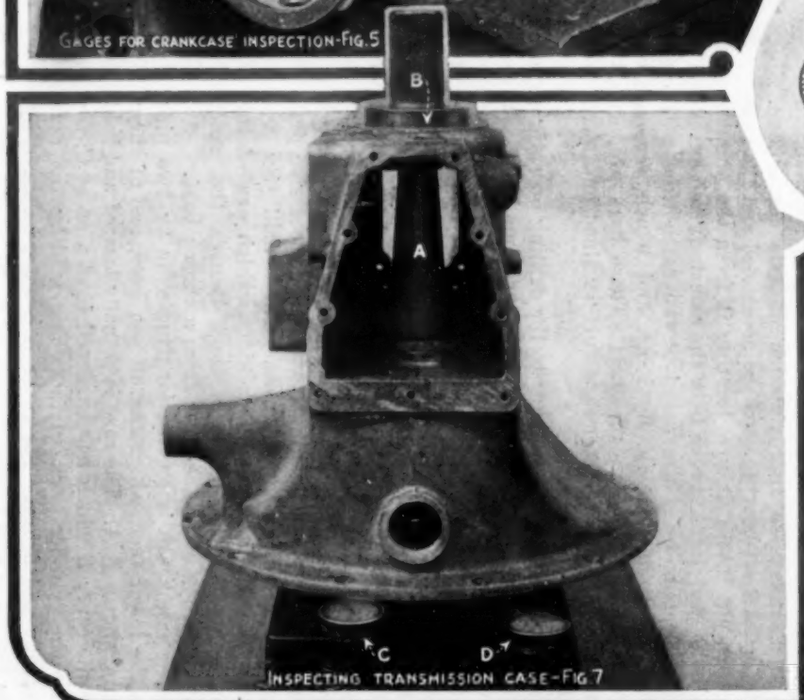
In order to insure the duplicate manufacture necessary for easy assembly into a motor of this class, great care is taken in the inspection of all the com-



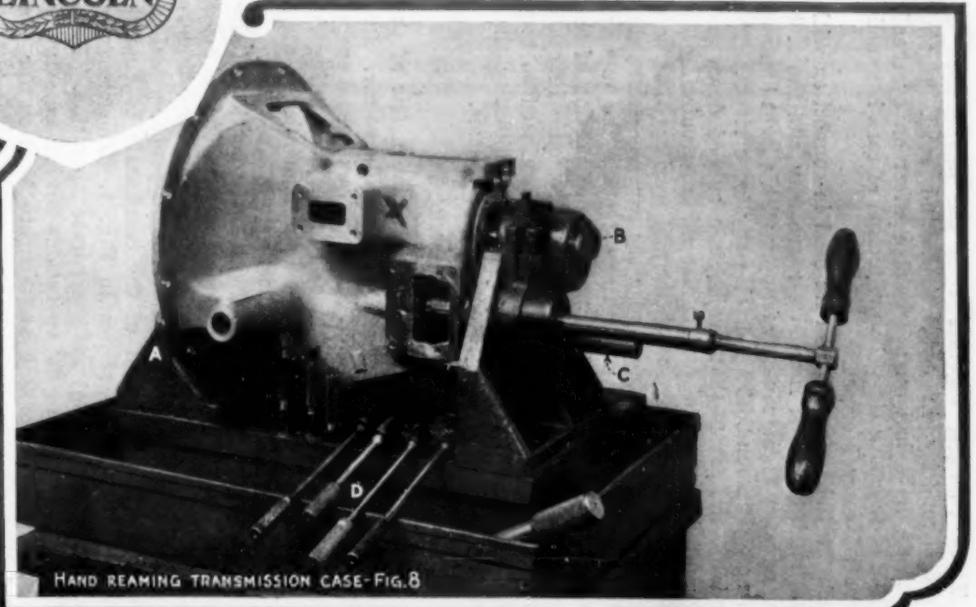
GAGES FOR CRANKCASE INSPECTION-FIG.5


REAMING FOR DRIVESHAFT BEARING-FIG.6

LINCOLN



INSPECTING TRANSMISSION CASE-FIG.7



HAND REAMING TRANSMISSION CASE-FIG.8

ponent parts. Figs. 3 and 5 show a few of the inspections on the crankcase and serve to illustrate the care that is taken all through the work. The gage in Fig. 3 tests the angle of the faces for the cylinder blocks. The crankcase is placed on the surface plate between the strips *A* and *B*, and the gage at the right moved until the upper end reaches over the angular surface.

Two dial gages, one at *C* and the other between the upper flanges, at *D*, show whether or not the angle of the face is correct. In order to be sure that this face is kept at the proper angle, the master gage *E* at the left is kept on the surface plate so that the gages can be tested at frequent intervals and without being sent to the toolroom for that purpose. Both the gages and the master are made of aluminum for ease in handling. The bearing surfaces, however, are of hardened steel.

A few more of the inspections on the crankcase are shown in Fig. 5. Needless to say all of the gages shown are not used at once but were put on in order to show as many of them as possible in one view. Beginning at the left, *A* is an arm which goes over the end of a mandrel that fits in the crankshaft bearings. This arm carries several dial indicators, only part of which are shown. Indicator *B* shows the squareness of the outer or transmission-case face with the crankshaft bores, while *C* shows the concentricity of the bore. Both of these surfaces affect the proper alignment of the transmission case.

For testing the faces for the starting motor and other auxiliaries, the bar *D* is put in place with the flanged collars *E* and *F*. The pin at *G* bears on the starter face and, as the collar is revolved, the indicator *H* shows the error, if any. The same collar tests the opposite surface, while collar *I* tests the gear-seat face in the front end.

The block *J* tests the distance of the face of the side opening from the bar *D*. Gage *K* shows the height of the face under the indicator point from the cylinder-block faces. Cylinder bolt-holes are gaged by a screw plug gage *L*. The two gages at *M* test the relaton of two right angled holes as shown in detail in Fig. 9, while gages *N* and *O* show whether the valve-slide guide holes are central with the camshaft or not. Details of these gages are shown in Fig. 10.

Details of Two Gages

Referring to Fig. 9, the large plug *A* fits into the end of the case and is located by the flange *B*. Plug *C* fits the right-angle hole and the front or "go" portion *D* slips past the end of *A* if the distance *X* is correct. If it is too small the end *D* will not pass the end of *A*, and if too great, the larger, or "no go" part *E*, passes the end of *A*.

The action of the camshaft gages *N* and *O* is shown in Fig. 10. The body *A* goes into the guide hole until the flange *B* rests on the face. In the position shown the plunger *C* touches the camshaft at one side of the center, and the indicator *D* is set to zero at this point. The body *A* is then turned half way around until the plunger is in the position shown by the dotted lines at *E*, and a reading is again taken. If they agree, the hole is central with the cam shaft.

The crankcase casting passes through three inspection operations, where it is observed for general appearance, shrinking spots or shrinking cracks, faulty chipping or snagging, and for thoroughness of cleaning. It is examined to see if soldering, welding, or possibly peening can be used to cover small sand holes, and is tested for leakage with gasoline. It is also tested on a fixture which holds it in the same position as on the first machining operation, to see if all bosses are properly located, and if it has the proper amount of finish.

As it progresses through the machining operations, the case passes six inspection stations or stages, where it is tested for possible defects as follows: First sta-

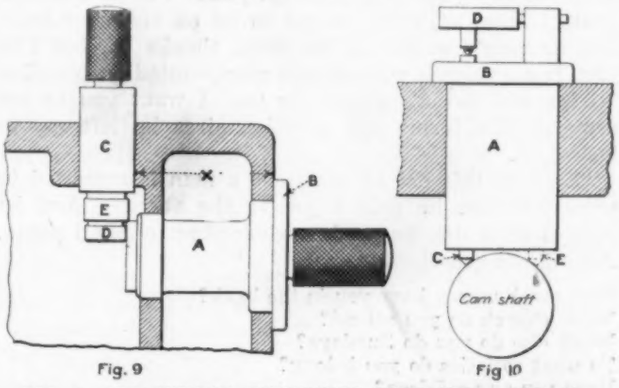


FIG. 9—MEASURING SHOULDER DISTANCE. FIG. 10—GAGE FOR VALVE-SLIDE GUIDE HOLES

tion, 5 points, second station, 9 points, third station, 4 points, fourth station, 19 points, fifth station, 29 points, sixth station, A 28, and B 23 points, or a total of 117 inspections. The cylinder block has a total of 26 inspections and the crankshaft 52, before it goes to assembly, where it is balanced and inspected.

It was found that the drive-shaft bearing in the transmission case did not always fit just as it should, and the quiet-room tests traced a little noise at this source. The fault was discovered to be due to a slight distortion of the metal between the studs and the bearing seat, due to screwing in the studs. This difficulty has been eliminated, as shown in Fig. 6, by reaming the bearing seat after the studs are in place.

In order to insure perfect alignment of gear-shaft holes, and also the correct center distances, the transmission case is hand reamed in the fixture, Fig. 8. It is located against an angle plate *A* in front and aligned by mandrels *B* and *C* in the drive-shaft bearing and gear-shaft holes. Then the auxiliary-shaft holes are reamed as shown. This view also shows at *D*, the gages used in inspecting the various holes.

For testing the concentricity of the transmission case, the fixture shown in Fig. 7 is used. The pilot *A* fits the lower bearing in the housing, and the plug *B*, which fits the upper bearing, also fits over the upper end of *A*, brings the two main bearings into line. Then the case is revolved on its bearings while the gages *C* and *D* test both the concentricity of the pilot or projection which fits into the crankcase, and the squareness of the flange face with the bearings. These tests insure correct alignment with the crankcase, which has been previously tested in about the same way.

After assembly the transmissions go into the quiet room, which has hollow tile walls and is completely isolated from shop noises. Here every transmission is given a number of severe tests for noise, and passed, or sent back for further refinement. The load on the transmission is not applied in the room, but the drive shaft extends through the wall so that no sound except that due to the transmission itself, can be heard in the quiet room.

Other features of Lincoln methods and refinements will appear later.

Hiring Men by Questionnaires

By John R. Godfrey

JOHNSON was all "het" up the other afternoon when I dropped in to see how his new motor was getting on. I'd hardly got my head inside the door before he said: "Glad to see you Godfrey, you're one of the best goats I know of, and I've got to let off steam or bust. No, nothing's wrong in the shop, thanks be, but I've just had a seance with a man who wanted to install a 'hiring and firing' system for us. I want you to see some of the forms and questionnaires he left me to look over.

"Look at this list of questions a man is supposed to answer before he gets a job in the shop!" And he handed me a list that took a whole sheet of legal paper. Among the questions were:

How much money have you in the bank?
What church do you attend?
What else do you do Sundays?
To what societies do you belong?
Have you any children?
Are your domestic relations harmonious?
Do you own your own house?
How much did you earn at the last place?
Do you own an automobile and what kind?
Do you use tobacco?
Do you drink?
Do you gamble?
Are you musical?
What is your hobby?

and so on till it looked like a laundry list in a hotel.

"Did you ever see so much damphoolishness in so little space in your life, Godfrey? How would you like to have to answer that list of questions in order to get a job in the shop which might not last over a week, if business slacked off?

"You ought to have been here when I told him a few things that made his hair curl. The poor fish seemed to think that because a man works with his hands, or works at all for that matter, he has to tell his life history before he can get a job. If a man shoved a list of questions like that under my nose, to answer before I could go to work, there'd be fireworks in about ten seconds. I'd have to need a job worse than I ever did to prevent me from telling him to g t h, with appropriate trimmings.

"Some people seem to forget that when a man works for you he has to give you more than you pay him, or else you couldn't run the shop. But this hire and fire expert acts as though the machinist was an applicant at a soup kitchen or an old man's home.

"Wouldn't it be a lot more appropriate if the machinist asked me how much money I had in the bank so he could know whether to take a chance on getting his money or not?

"Are your domestic relations always harmonious, Godfrey? Not more than mine are, I'll bet. Now don't get the notion that Mrs. J. and I waste any time scrapping—any more than you do. But we don't always agree by a long ways, and there are times in any family when harmony gets an awful kink in it for a little while. His alibi for such a question is that family relations affect a man's work. Of course they do. But if none of us who ever had family arguments got a job, there'd be several million permanently unemployed.

"This quizzing a man as to personal history always gets my goat, Godfrey. What I want is a fair day's work for what I pay, reliability within reason and as much loyalty as I deserve. A lot of us think it's all one sided, you know. But as long as the boss fires a man on a minute's notice he hasn't much of a kick coming when a man leaves for a better job or a better boss, on equally short notice.

"I know the theory that all these factors affect a man's work and it's largely true. But by the same token the outside doings of the boss also affect the man's job both as to its being agreeable and permanent. If the boss plays poker he has a husky nerve to ask an applicant for work if he gambles. And too frequently his hobby, whether it is golf or indoor sports, takes so much time and energy that the business suffers and the man's job goes to pot.

The Liar Who Made Good

"Questions like those have no place in any good shop, Godfrey. No red blooded man can answer them without cussing inside, even if he wears a cast iron smile while he does it. The man who proposes such questions has the idea that we are doing a man a favor to give him a job. In reality it is, or ought to be, a fifty-fifty proposition. We really need the man just as much as he needs us. Idle capital is a liability instead of an asset and does not produce any more than idle men.

"There's another side to this questionnaire business too, Godfrey. One large shop I know used them a while. They found that the best answers always came from the 'floaters' because they had filled in so many papers they knew just about what sort of answers the hire and fire man wanted. That same shop had one funny experience, too.

"They hired one man who turned in a fine answer sheet. He owned his own home, had money in the bank, went to church regularly and came so near being a he-angel that I'd have looked for wings sprouted under his coat. After he had been at work a while, they found out that he'd lied about every last thing on the list. When they asked why, he told 'em he'd had enough experience to know what kind of answers they wanted and he needed a job."

"Did they fire him?" I asked.

"No, by thunder, they didn't. They took a tumble to themselves and their system. This self acknowledged liar proved to be one of the best workmen in the shop, and so instead of firing him they fired the questionnaire. Some people do recover from the disease, you see, though it's rare."

Synthetic Foundry Iron

The feasibility of producing a good grade of foundry iron from steel scrap in the electric furnace has been demonstrated in experimental work performed by the Department of the Interior at the Northwest experiment station of the Bureau of Mines at Seattle, Wash. This development permits any manufacturing plant to use all its iron scrap on the spot in making castings equal to if not better than those from cupola iron. Improved methods of charging the 300-lb. experimental furnace used by the Bureau of Mines gave more rapid carburization, and carbon content as high as five per cent were reached. Several heats were made in a one-ton commercial electric furnace of the Heroult type, at Hoquiam, Wash., and in a one-ton indirect-arc, rocking furnace in a foundry at Detroit, Mich. In every case, these tests were successful in producing sound, strong gray iron from steel scrap and iron turnings.

Manufacturing a Precision Tool

BY ELLSWORTH SHELDON
New England Editor, *American Machinist*

Preparatory operations on frames—Frames and sleeve in one piece on all sizes below 9 inch—Threading the main and adjusting nuts by tapping—Rigid inspection methods

THE MICROMETER caliper as a means of making precise measurements has long since become an indispensable tool, not only to toolmakers and others whose work regularly involves the "splitting of tenths" but to the average manufacturer whose product does not in itself demand an extraordinary degree of accuracy, yet who finds it necessary to hold parts in progress to within very close limits in order to facilitate assembling and cut down production costs. Limit and snap gages are invaluable as accessories to the production of small parts but such gages can only inform the user that the work is too large or too small, they cannot tell how much, and there is a marked tendency toward the substitution of the micrometer for them because of its wider range of application.

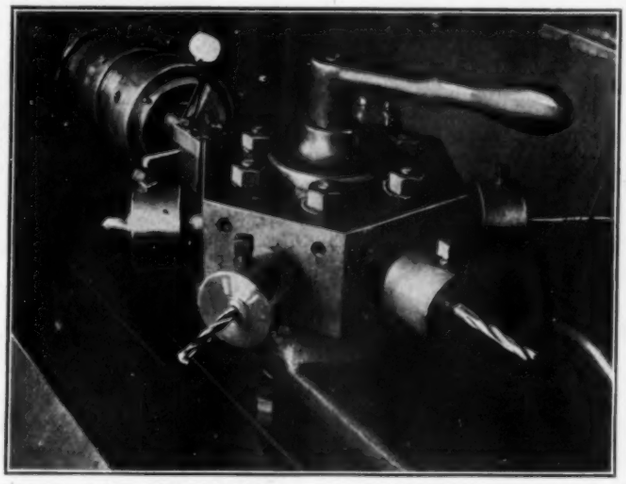


FIG. 1—DRILLING, REAMING AND TURNING THE SLEEVE

The steadily increasing demand for micrometers has necessitated the application to their manufacture of intensive production methods. Though there still remain many operations in which the skill of the workman counts for much in the accuracy of the final product, special machines and devices have been evolved for performing tedious and exacting repetitive operations, thus rendering the personal equation of less relative importance and insuring exact duplication of parts.

Among the earlier producers of micrometer calipers was the J. T. Slocomb Co. of Providence, which company's devices, adaptations and methods of manufacture are here shown and described. The special devices were all designed and made in the factory as the growth of the business warranted. The above named company was among the first to place on the market the enameled drop-forged frame familiar to all users of Slocomb micrometers, and though micrometers with other styles of frame, as well as the Davenport "direct-reading" micrometer, are manufactured by them, the methods applied to the principal parts are as here described.

In all Slocomb micrometers up to the 9-in. size, the frame and sleeve are in one piece. Preliminary operations in the way of sand-blasting, filing and straightening the forgings being attended to, the first machining operation is drilling, reaming and turning the sleeve in the Warner & Swasey turret lathe as shown in Fig. 1. A special chuck is made for the spindle nose of the machine to hold the frames, which are held in place and aligned with the tools by a single thumbscrew.

All six positions of the turret are used, the successive steps in the operation being centering, first and second drilling, reaming, and rough and finish turning. The two latter operations are performed by box tools fitted with a central stud, or arbor, to preserve the alignment. After the finish turning, the sleeves are ground to finish size, 0.005 in. being left by the turning tools for the grinding wheel. A standard grinding machine, shown in Fig. 2, is used, without special equipment other than the cut-out driving plate and extended center to be seen in this illustration. The work is held on centers.

Following the grinding operation the hole in the sleeve is hand reamed and the frame then goes to a drilling machine for drilling the small blind hole in the opposite end of the bow to receive the "tip," or anvil. Long drills, passing through the hole in the sleeve and supported close to the work by jig bushings, are used for this purpose. The end of the bow is then form milled to correspond to the large end of the tip, though the latter is not set at this stage.

The frames then go to a special device which rolls the twenty-five-thousandth graduations on the sleeve, corresponding to each complete turn of the measuring spindle. The device consists of a frame carrying two parallel (horizontal) jaws of hardened steel, one of which is smooth and, except for a screw adjustment for the purpose of regulating its distance from the opposed jaw, stationary. The opposed jaw is a die having cut in relief upon it the 30 short lines and the 11 longer lines of the graduation. The eleven numerals from 0 to 0, as shown in Fig. 3, are also cut on this die.

The lower jaw, which is the die, is fitted to slide endwise with relation to the upper one. The operator places a micrometer frame in position with the sleeve

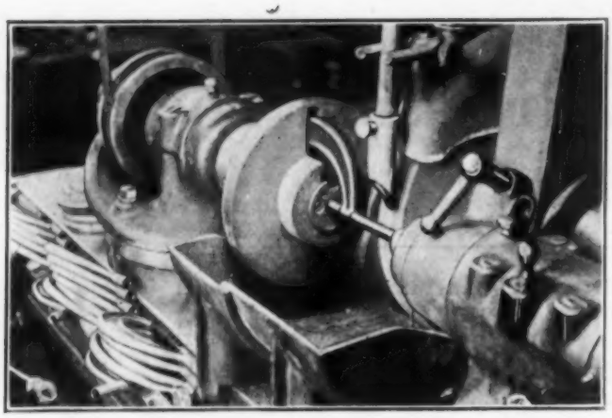


FIG. 2—GRINDING OUTSIDE OF SLEEVE

between the jaws, brings down the upper jaw by means of the screw adjustment to grip the sleeve, and moves the lower jaw to the left with a hand lever. This movement causes the sleeve to roll between the jaws and as it passes over the relief lines and numerals of the die the impression of the letter is left in the soft metal of the sleeve. An arbor is wrung into the hole in each sleeve before setting it in position in order to forestall possible distortion.

Up to this stage there is a through hole of uniform diameter in the sleeve. In the next operation a short bushing is pressed into the sleeve at the end next to the bow, reducing the diameter of the hole at this point

FIG. 3—DIE FOR GRADUATING THE SLEEVE

to the size of the measuring spindle. Both ends of the hole through the sleeve as well as the blind hole in the opposite end of the bow are now closed with metal plugs and the frames go to the enameling department.

Enameling is done by the dipping method, four coats being applied and baked successively. Though care is exercised to keep the enamel away from the already finished parts when dipping the frames, it is necessary to pass them through several minor hand operations in order to free the sleeves from enamel, to strip the enamel from the little pad upon which the size of the tool (when the size is larger than one inch) and the trademark is to be stamped, and to polish the sleeve. Fig. 4 shows the racks of work upon which the work is transported, just after the frames have come from the enameling department.

Tapping the sleeves for the main nut completes the work upon the frames up to the point of assembling. In the meantime the anvils, measuring spindles, main and compensating nuts and thimbles have been brought up to this stage, partly upon screw machines and

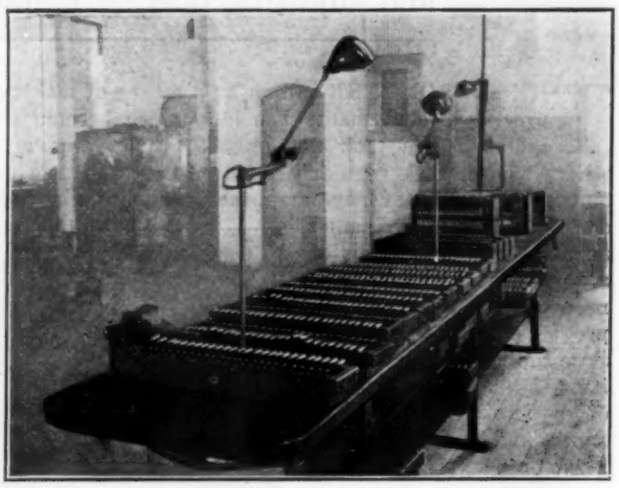


FIG. 4—THE WAY THE WORK IS TRANSPORTED

partly upon special machines and devices to be described.

The anvils and bushings are almost entirely the product of screw machines, the thimbles nearly so, and the main and compensating nuts are completed up to the point of threading except for the serrating of the mating surfaces of the latter, which is done upon a small automatic milling machine specially designed for the purpose.

The threads upon the measuring spindles are cut upon automatic machines having master-screws of large diameter and of the utmost possible degree of accuracy. Even with all the care exercised in the building of these machines, there will be variations from true pitch because of temperature changes, and each machine must, therefore, incorporate somewhere in its mechanism a compensating device by means of which all errors from this cause may be eliminated.

Every spindle is subjected to an exacting test before it is assembled into a micrometer. An error in pitch of one ten-thousandth inch in any part of the length is sufficient cause for rejection, yet so cleverly are the machines devised and so skilfully operated that the number of rejects is surprisingly small.

Though the thread of the measuring spindle is the vital feature of a micrometer caliper, the nut in which it turns is of almost equal importance, and the manufacture of these nuts involves some very careful and painstaking work. Each nut is in two parts—a main and a compensating nut—as shown in Fig. 5. Once the internal threads are cut upon these two parts, each pair becomes an individual unit and must not be separated at any succeeding stage of the assembly.

Any two of the pieces as they come from the preced-

ing operations may be placed together in the tapping jig shown on the end of the lathe in Fig. 6, in which they are clamped with their serrated faces held together by the pressure of the binding screw. While in this jig, and before tapping, a witness mark is scribed across the periphery of the two shoulders in contact so that in later operations the two parts may be placed together always in the same relation. The witness mark is invaluable to the user when he desires to make readjustment of the tool to compensate for wear.

Three taps are run through the combined nuts, making a continuous thread clear through both parts, and any disturbance of the relative position as indicated by the witness mark will break the continuity of the thread. Peg boards are provided to handle the work after the tapping is done, and the pairs of nuts are never removed from the pegs (except one pair at a time as subsequent operations require) until the nuts are finally assembled into their respective frames.

The internal thread is a sharp V, of 60 deg. included angle and 40 pitch. As these threads are necessarily an exact replica of the taps, the latter are the parts upon which extreme care must be expended in order to produce accurate results. Once the taps are made and found to be correct it would be impossible to produce other than correct threads in the nuts.

The next operation is that of cutting the threads upon the outside of the main nut. In Fig. 7 may be seen a peg board with the pairs of nuts as they come from the tapping operation. The operator removes one

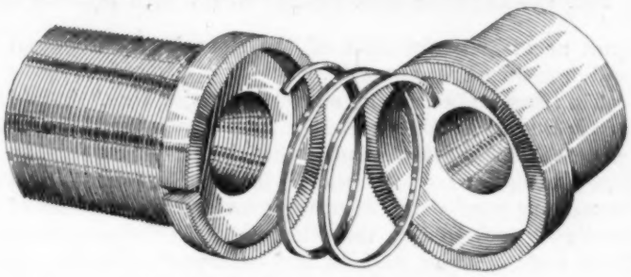


FIG. 5—THE DOUBLE ADJUSTING NUT

pair of nuts from its peg, lays the adjusting nut aside for the moment, runs the main nut on a threaded arbor and cuts the thread with a single point tool in the usual manner. The two parts are again placed together and restored to the peg from which the pair was taken.

The external thread, also a 60 deg. sharp V, is of 32 pitch. Though it is made with the same care as is given the other parts, it bears no relation to the internal thread so far as measuring is concerned and, except for the purpose of making an adjustment, it has no movement with relation to the frame after it is assembled into the micrometer. The machine used for cutting it is a standard engine lathe fitted with a special lever-operated single-point threading tool. As the tool reaches the clearance space at the end of its cut the split nut of the leadscrew is opened automatically, the threading tool withdrawn and the carriage of the lathe returned to a stop by means of a weighted cord passing over a sheave attached to the shears of the lathe.

The principle of the double nut in the Slocomb micrometer is as follows: The outward thrust of the measuring spindle (in the direction in which thrust would be caused by setting the measuring surfaces of the tool in contact with a piece of work to be measured)

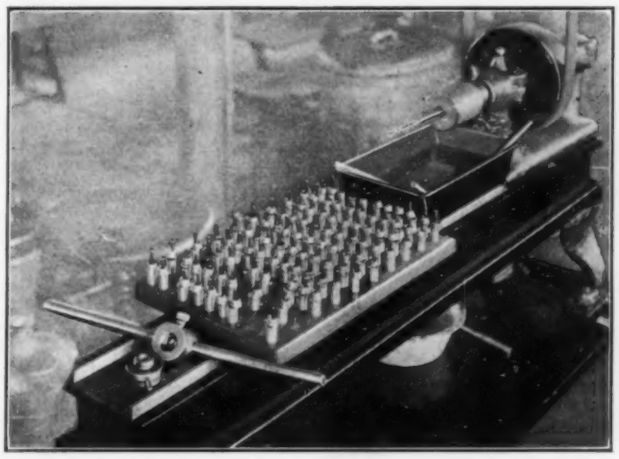


FIG. 6—TAPPING THE NUTS

is always borne by the main nut. When, in course of long usage, the thread becomes sufficiently loose to allow end-play of the spindle the inward thrust would be borne by the adjusting nut because the latter tends to move away from the main nut by reason of the energy of the coil spring between them.

When there has been sufficient wear to allow an endwise movement of the spindle the latter is withdrawn just far enough to clear the thread of the main nut and the adjusting nut is turned forward (toward the bow) over one of the serrations of the mating faces. This has the effect of bringing the inward bearing angles of the thread in the main nut and the outward bearing angles of the thread in the adjusting nut closer together and thus elminates the looseness. No tools are needed to make this adjustment.

To compensate for wear of the measuring surfaces or for any redressing of them necessitated by wear or accident, the measuring spindle is run back only for a distance that will expose the shoulder of the main nut

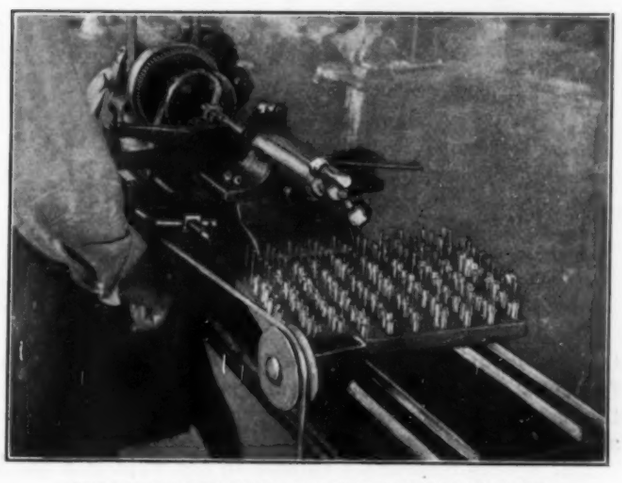


FIG. 7—THREADING OUTSIDE OF MAIN NUT

and the latter turned forward by means of a small spanner that is furnished with each micrometer. One complete turn of the main nut will cause it to advance in the frame a distance of 0.03125 in., but at the same time it has *unscrewed* from the measuring spindle one turn of the 40 pitch thread, or 0.025 in., resulting in an actual advance of the spindle of but 0.00625 in.; equal to the difference in pitch between the two threads. This

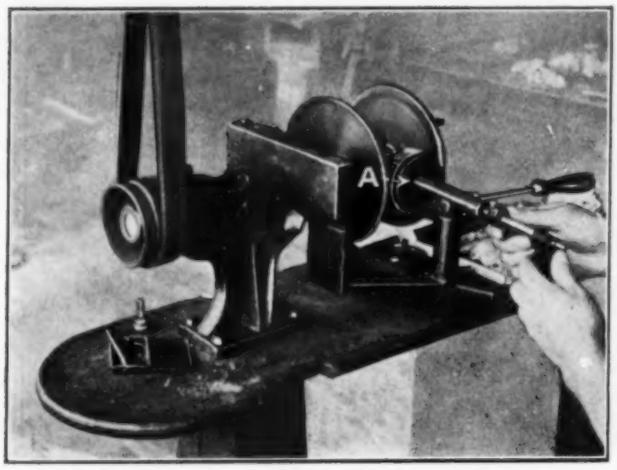


FIG. 8—DEVICE FOR RUNNING IN THE SCREWS

differential movement renders minute adjustments easy of accomplishment.

The first operation of assembling is the fitting of the nuts to the frame after which the small bushing previously mentioned as being forced into the hole in the sleeve is hand reamed by means of a reamer that passes through and has a bearing upon the threads of the nut,

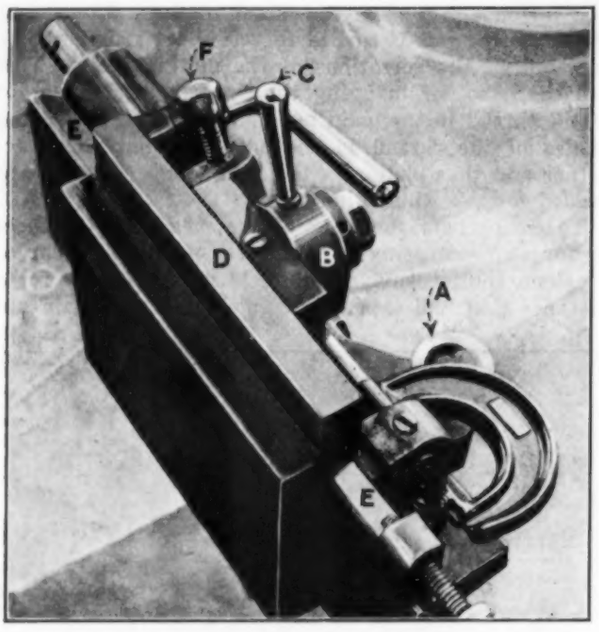


FIG. 9—LAYING ON THE MAJOR LINE

thereby insuring alignment of these two parts. Each frame is then fitted with a measuring spindle, which thereafter remains with it through all subsequent operations.

Fitting the measuring spindle to the nuts is a hand operation in which the operator, while retaining complete control of the work, derives no little assistance from the device shown in Fig. 8. The operation consists mainly of running the spindle rapidly back and forth through the nuts until it acquires a smooth free action but is without shake. Though this operation is referred to as lapping, the only material used upon the threads is vaseline.

Holding a micrometer in his hand the operator grips one end of the measuring spindle in the chuck of the machine and causes it to run first in one direction and then the other by pressing the small rubber-tired wheel *A* alternately against the revolving disks on either side. The action is no different than would be accomplished by turning the spindle by hand, but is much faster and less fatiguing to the operator.

It will be remembered that the die shown in Fig. 3 carried no long line at right angles to the graduations, and the micrometer user may have wondered at the omission. It is because this long line, approximately parallel to the axis of the sleeve, must be absolutely parallel to the line of traverse of the measuring spindle

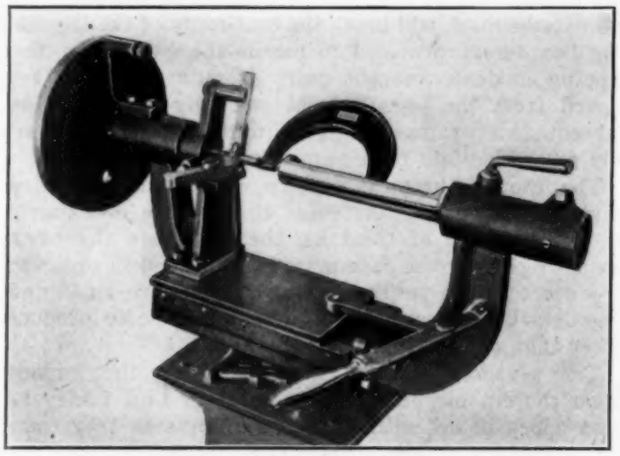


FIG. 10—MARKING THE DIVISIONS ON THE SLEEVE

(not necessarily the axis of the sleeve), else the tool will not measure correctly.

This line, called in the shop the "major line," is laid on by the device shown in Fig. 9, in which the micrometer is held by the spindle, that has now become an inseparable part of it, instead of by the frame. The stationary part of the device is provided with means of centering and holding the micrometer by the spindle at both ends. When so held, the micrometer is free to turn about the now stationary spindle and the weight of the bow is supported by the adjustable pad *A*, which may be elevated or depressed by rotating the knurled head. The marking tool is a steel cutting point set into the lower side of the eccentrically mounted holder *B*, which may be likened to the clapper box of a shaper in that the tool may be lifted from the work by press-

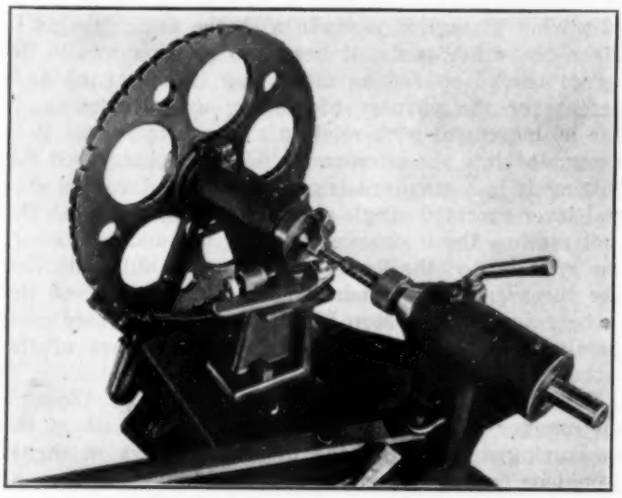


FIG. 11—PUTTING THE SHORT MARKS ON THE THIMBLE

ing back the small handle *C*. The tool holder is thus a part of the slide *D*, which in turn is accurately fitted to slide on the stationary bar *E*.

With a micrometer in the machine the operator adjusts the height of the cutting tool to the work by turning the knurled screw *F* and raises or lowers the bow by turning the elevating pad *A* until the tool just cuts the ends of the short lines already on the sleeve; using a magnifying glass for both of these adjustments. When the micrometer is located to his satisfaction he has but to remove his thumb from the handle *C* and draw the slide forward until it contacts with a stop screw; which completes the job.

Two machines are shown in Figs. 10 and 11 for laying graduation lines on sleeve and thimble respectively. On micrometers designed to show a vernier reading to 1/10,000 in. there are several lines on the sleeve parallel to the major line which must be spaced to an extraordinary degree of accuracy. The first of these machines is for this purpose. Here, as in laying on the major line, the micrometer is held by opposite ends of the measuring spindle.

FIG. 12—THE FINAL INSPECTION

The second machine marks the 25 evenly spaced short lines on the beveled end of the thimble. The machines are identical in principle but differ somewhat in detail according to the nature of their work. Both are entirely hand operated and occupy a floor space that is free from moving machinery and consequent vibration.

Something besides cleverly devised machinery and constant process inspection is necessary to the production of quantities of tools that are to meet requirements so exacting as those imposed upon micrometer calipers. During the process of manufacture each tool is adjusted with exactness, tested to insure smooth and free operation and made ready for the finished stock room, but it is not, even then, allowed to go into stock. The sole duty of the man shown in Fig. 12 is to find fault with the product and every micrometer must pass through his hands and receive his approval.

Each micrometer is tested by him for accuracy of reading at not less than four positions of its spindle, and the number of tests may be increased to ten, twenty, or even more positions if the first tests indicate a possible error. Johannsen gage blocks constitute the final authority, and the working gages are ground disks of steel, frequently checked against the "Jo-blocks" to forestall any possible error due to wear of the gages.

The Arc Welding of Alloy Steels

By C. J. Holslag

Chief Engineer, Electric Arc Cutting and Welding Co.

Once the theory of arc welding is understood, it would seem perfectly feasible to arrange for the deposit of any kind of alloy by simply introducing this alloy into the weld through the fusion of an electrode composed of the desired substance. This process, however, is not as easy as would at first appear, due to several causes. As a matter of fact, it has already been definitely stated that the absolute temperature of the arc is entirely too high for the simple melting of any metal. In actual welding practice, this temperature is reduced by various means—principally by holding as short an arc as possible, and by providing a surrounding mass large enough to absorb the surplus heat. This gives us the clue to the proper manipulation of the welding temperature, and makes clear the necessity for precaution in keeping the deposit unburned.

All commercial metals, especially iron and steel, contain a certain percentage of impurities, some of them desirable in the welding operation, and others a hindrance. It seems as if fate were intent upon allowing the desirable foreign substances to vaporize and escape at the high temperature of the arc, while the less desirable impurities remain behind. For instance, certain portions of the carbon, manganese, vanadium and other elements used in alloy steels will invariably escape when an attempt is made to deposit them in a weld. There is but one known method of depositing them intact, which is really a combination of two expedients. One of these is to incorporate in the weld certain compounds which produce inert gases, and so tend to minimize the oxidizing action under which the desirable impurities are burned out. The other is to provide the electrode with a heavy coating of some refractory substance, such as silicon, or silicon slag, which forms a physical coating about the bead and prevents oxidation.

Passing Alloys Through the Arc

In spite of these difficulties, the electric welding process has been developed to a point where it is perfectly possible to pass manganese, high carbon, nickel, chrome, or vanadium through the arc in any combination. It will at once be seen that there are excellent possibilities thus afforded, because most of these alloys give properties to the metal that are extremely desirable, especially where the original heat-treatment can be duplicated.

As far as arc welding is concerned, the alloy nickel has been developed to the most useful extent. The use of this alloy in relatively small quantities, together with medium carbon, will produce a marked increase in tensile strength and other advantageous physical properties. Welds made with nickel alloys appear to have a tendency to cause the appearance of what seem to be small incipient cracks on the surface. These cracks, however, do not extend in use, and appear to be more in the nature of scale cracks. They may be made to disappear entirely by using a combination of nickel, chromium and carbon in the electrode.

From the Journal of the American Welding Society, and to appear in a handbook published by the McGraw-Hill Book Co.

All usable alloys of steel contain carbon. Small amounts of manganese invariably accompany this carbon, and in this quantity, it is far from being undesirable for welding. Sulphur and phosphorus, however, are eminently undesirable in any amount, and unfortunately, there has as yet been developed no material aid in ridding the weld of their presence entirely. Silicon in or about the weld tends to float the sulphur and phosphorus to the surface, and so is helpful. It is best, however, to do away with these two impurities as far as possible in the electrode itself; then to provide means for holding the other and more desirable compound in the weld.

As already stated, certain alloys have been developed which are successful in being deposited thus intact, and one of the most remarkable as well as useful, is found in the combination of relatively high carbon, which will deposit a tool steel cutting edge on any mild steel base. The time seems not far distant when this process will become sufficiently well known to eliminate the tool steel industry as such.

This process is sufficiently interesting to be described in detail. In ordinary welding, the metal is melted into a viscous mass, which usually has sufficient coherence to remain where it is deposited. In tool steel welding, however, the metal must be kept perfectly fluid and molten, and is prevented from oxidizing or spreading by being deposited in a trough built up around the welding area of some plastic and refractory material. This trough may be made by molding carbon or carbon paste, graphite, asbestos, silicates or similar substances not affected by the arc, and is necessary because the metal must be prevented from running out of place while the required puddling action necessary to combine all the compounds in the world is performed. The metal is kept molten under the further protection of the slag covering of the electrode, which forms an envelope enclosing the metal while it crosses the arc from the electrode tip to the puddle.

This process is the only one in which the puddling operation should be thus performed. Other metals must be deposited relatively as cold as possible in order to insure a minimum of opportunity for the molten metal to absorb oxygen and nitrogen and so to burn out the desirable impurities.

Welding in Automotive Work

The welding of springs, bumpers, axles, and other parts of alloy metal in automotive work is, in most cases, entirely feasible and useful. The breaking of leaf springs is usually met with in this connection, and their repair is usually entirely practical by the electric arc process. A spring is welded to the best advantage if it breaks near the eye, through the center bolt-hole, or if the break occurs in any one of the smaller leaves. If the break should be found to be isolated in one of the large leaves, the efficacy of the weld will not be as good as in the other cases. Fortunately, however, as springs are now built, breaks usually occur at the points first mentioned.

It is perfectly feasible to weld a spring with every leaf broken in the center if the leaves are separated and welded one at a time, and the entire spring reassembled, after which if a pad or band is welded all around the entire spring, filling up the hole originally occupied by the bolt, the spring will be safe. The bolt head on the upper side of the spring may be duplicated by a welded button, and the rubber bumper bracket may also be tacked in place. All this work must not be done so rapidly or so continuously that the temper will be taken out of the spring. It is good practice to guard against this by dipping the spring in water at intervals, or by adding water to the welding surface.

If the break occurs near the eye it will be necessary only to deposit a sufficiently heavy pad to prevent any bending. When one of the smaller leaves is to be welded, before operations commence, the spring should be so clamped that each leaf bears its share of the load. In other words, each leaf must have its accustomed flexure or curvature while the weld is being made. While this condition usually demands skilled attention, it is not difficult to copy the original design when there are but one or two leaves broken.

Bumper breaks usually occur only in two places; where the bumper is bolted to the frame or bracket, or where the bend occurs. In welding a break at or near the bolt hole, it is always good practice to provide additional strength by adding a generous pad where the break occurred. For it is logical to suppose, that, if the section at this point was originally inadequate in strength, merely reduplicating it will not suffice, and therefore it is best to provide extra strength at this point. If the break occurs again, even after the extra padding has been added, it may be found expedient to grind or saw off the end so that the weld does not come at the hole. When the bumper breaks at a bend, it will generally be found that the defect was due to a flaw created in the bending process, and a weld made with ordinary care will be sufficient to correct the trouble permanently. When alloy axles break, there is no reason why their cross-sections cannot be increased by a pad sufficiently heavy to obviate the recurrence of the break.

Nickel in Welding Rod Advantageous

In all alloy welding done in automotive practice, the presence of nickel in the welding rod is a very material aid in preventing the vaporization and escape of the desirable compounds of the alloy. An ordinary welding rod should not be used because it will allow these compounds to escape through the molten metal, and the beads formed will present a mushroom or gingerbread-like appearance. This is caused by the escaping gaseous oxides, which force their way through the molten weld. Practically every alloy has a much lower melting point than steel, due mainly to the presence of carbon in these alloys in excess of that present in ordinary steel. This means that, in any case, the operator must exercise greater caution to prevent the burning-out of the metal.

In fine, as far as the development of alloy steel welding has thus far progressed, the best practice is found in duplicating the parent metal as far as possible in the electrode. In the great majority of cases, however, it has been found that various combinations of nickel in the welding rod will not only prevent the escape of alloy oxides, but that a nickel or a nickel-chrome electrode will sufficiently duplicate the physical properties of most alloys to produce entirely satisfactory results

A nickel-chrome welding rod deposited on a mild or carbon steel base will produce a weld possessing a tough, self-hardening surface that will prove ideal in resisting friction and wear. Where it is possible to effect no treatment but that of air-hardening, this deposit is often better than the original alloy for every purpose.

Selection of Milling Cutters for Helical Involute Teeth

By ERNEST WILDHABER

A new formula for tooth number of formed milling cutter to cut helical involute teeth—Based on mathematical principles and easy to use — Different results from old formula

THE selection of formed milling cutters for helical involute teeth presents a problem which has not been satisfactorily solved hitherto. When the number of the cutter is determined in the usual way, the teeth of the helical gears produced tend to be undercut, the profiles actually produced receding from the correct profiles on the addenda and the lower tooth flanks. Such gears give short tooth contact.

The present inferiority of milled helical gears is due to improper selection of cutters, but it is possible to select a cutter so that correct helical teeth will be produced. A method for determining the number of the cutter is outlined in the following discussion and the application of the formula will be found very simple and practical.

The derivation of the expression is, however, neither easy nor simple, but the outline of the deduction will be given. All the steps are based on accurate mathematical proof, which is considerably involved and will not be given in detail.

An inclined milling cutter *M* is shown in Fig. 1 in cutting contact with a helical involute pinion, and Fig. 2 shows a view of the same cutter and pinion, looking in the direction of the cutter axis.

Finished Profile Depends on Cutter Position

A milling cutter cuts along its profile as long as it cuts straight teeth. In other words, if the cutter illustrated in Fig. 2 were to cut straight teeth, the finishing cut would be made along its profile, or meridian, which is projected into line *CO*. Provided the cutter had radial flutes, the cutting profile would be identical with the cutting edges of the teeth.

The cutter shown in Fig. 2, however, has rake flutes and in this case the profile of the cutter body differs somewhat from the profile of the cutting edge. In the following discussion the cutting profile will be understood to be the radial profile of the surface of revolution in which the cutting edges are situated.

When cutting helical teeth the milling cutter does not apply its finishing cut along its profile, on account of the warped nature of helical surfaces, and a normal section through the helical teeth does not fit the profile of the cutter body. On the contrary the fit, between the cutter and the tooth it produces, is along certain oblique lines *F* and *F'*, Fig. 2, where *F* represents the line of contact on the near side of the cutter and *F'* on the further side.

The lines *F* and *F'* are symmetrical lines which must, of course, be situated on the cutter body, and their location on that surface depends on the cutter diameter, the profile of the cutter, and the angular setting of the cutter with respect to the blank. We will call *F* and *F'* finishing lines since the cutter applies the finishing cut along these lines.

Points *P* and *P'*, which are the points in which the finishing lines *F* and *F'*, respectively, intersect the profile or meridian, can be readily determined by drawing perpendiculars to the cutter body through the pitch point *O*. Fig. 1 shows the cutter profile in a section

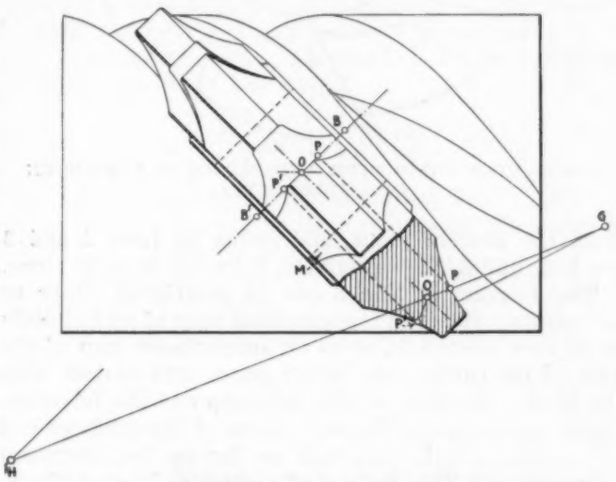


FIG. 1—PLAN VIEW OF INVOLUTE MILLING CUTTER CUTTING HELICAL TEETH

through the axis and parallel to the drawing plane, and the perpendiculars *OP* and *OP'* are indicated. *P* and *P'* are the points where the perpendiculars intersect the cutter body, and point *O* may be considered as the contact point between the pitch cylinder of the gear and the pitch cylinder of the cutter. *O* is situated at a radius *R* from the gear axis, and at this radius the helix angle equals the angle of inclination of the cutter.

As already mentioned, *P* is one point of contact between cutter body and tooth surface, and the two surfaces must, therefore, have a common tangential plane passing through *P*. We will further consider the surface areas of cutter body and tooth about the point *P* in an endeavor to determine the relations of these areas to each other.

A topographical map of the cutter surface around *P* is shown in Fig. 3. This map is based on the common tangential plane in the same way that a topographical

map of a section of the earth's surface is based upon the sea level, or other datum plane. Lines 1, 2, 3, 1′, 2′ and 3′ are lines of equal altitude or elevation from the tangent plane. Points on the cutter surface which are projected into line 1 are all the same small distance, dZ,

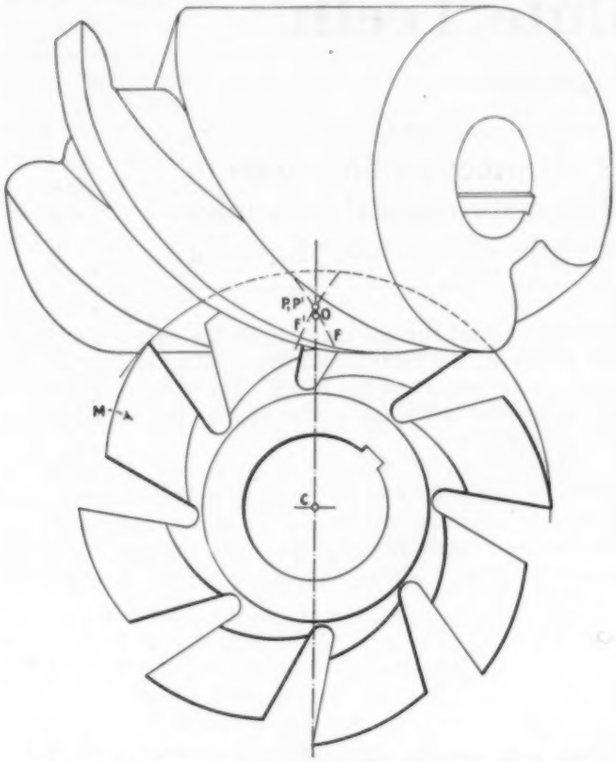


FIG. 2—VIEW OF CUTTER AND BLANK IN DIRECTION OF CUTTER AXIS

from the tangent plane, and points on lines 2 and 3 are $2dZ$, and $3dZ$, respectively, from the tangent plane.

The diagram in Fig. 3 can be considered either as an infinitely enlarged topographical map of an infinitely small area around P, or as an approximate map of the part of the cutter body which comes into contact with the blank. In other words, this map and the following figures consider only the curvatures of the surfaces and are mathematically accurate as far as the curvature is concerned. This method of procedure insures simple results which will, nevertheless be very closely approximate.

Curves 1, 2, 3, 1′, 2′ and 3′ of Fig. 3 are hyperbolas. This fact is determined from the curvature radius GP of the cutter profile, Fig. 1, together with the radius of curvature of the cutter surface in a section taken through PH perpendicular to the cutter profile. The profile of this lateral section of the cutter body is convex and its center of curvature is at H. An arc of a circle with the radius HP will most closely approximate the actual intersection curve.

In Fig. 4 a similar map of the helical involute tooth surface about the point P is shown. This surface touches the tangent plane along a straight line passing through P, which is tangent to the base cylinder. Other lines drawn through points on the tooth surface at equal distances from the tangent plane are also straight and parallel to the line through P.

The lines I and I' actually converge but since we are considering an infinitely large map of an infinitely small area around P, their intersection point has shifted away into infinity so that the lines become parallel. The curvature of the helical involute tooth surface through P is therefore equal to the curvature of a cylindrical surface, and the radius of this surface is PB, shown projected in Fig. 1. Point B is the contact point of the normal line through P with the base cylinder of the involutes.

Line PA, Fig. 4, is inclined at an angle w with the line PX of Fig. 3. If a be the pressure angle of the cutter, which is also the normal pressure angle of the gear, and h is the helix angle through O and, therefore, the helix angle in the pitch circle and the setting angle of the cutter, angle w may be determined by the expression:

$$\tan w = \sin a \times \tan h$$

The two maps are superposed upon each other in Fig. 5 so that the points P and the lines PX coincide. We are determining the proper cutter body for the given tooth and it is evident that the proper cutter must fit the given cylindrical surface in Fig. 4. Corresponding lines 1 and I, 2 and II, at equal distances from the tangent plane must therefore touch each other. It is evident from Fig. 5 that the cutter body does not contact with the tooth along the cutting profile PY, but along an oblique line F drawn through P and the contact points.

Curvature Radii of Cutter Surface

The area around P on the other side of the cutter shows exactly symmetrical conditions, and the results having been determined for one side of the cutter, can be applied to the other side as well. Fig. 5 furnishes the following relation between the various radii of curvature, based upon the knowledge that the two surfaces contact with each other along a line F:

$$R_o = R' \cos^2 w - R'' \sin^2 w \qquad (1)$$

in which

R' = curvature radius of the cutter profile (GP)

R'' = curvature radius of the transverse section of the cutter body (HP)

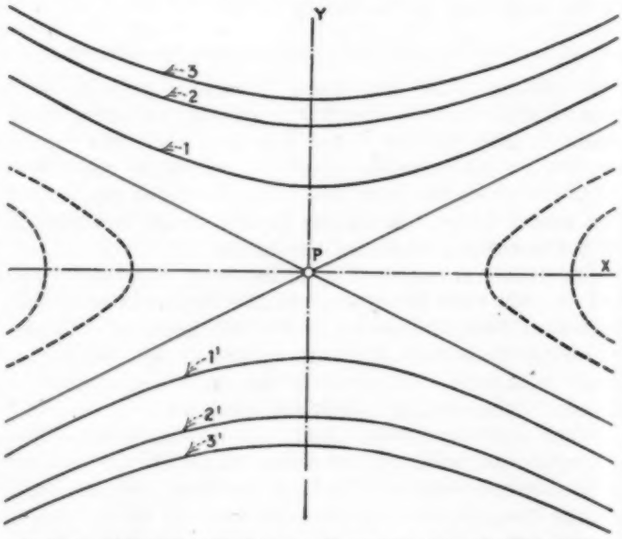


FIG. 3—TOPOGRAPHICAL MAP OF SMALL PORTION OF CUTTER SURFACE ABOUT P

R_o = principal radius of curvature through P of the helical involute teeth, and also the radius of the substituted cylindrical surface in Fig. 4.

From this equation an expression for the sought tooth number N_c, to which the formed milling cutter should correspond, can be found as follows:

$$N_c = \frac{N}{\cos^3 h} + P \times D_c \times \tan^3 h \qquad (2)$$

N = number of teeth in the helical gear
P = diametral pitch of the cutter
D_c = pitch diameter of the cutter, the other symbols being the same as previously noted.

This is the formula to be used in the selection of a proper cutter, and it is interesting to note that it contains the expression $\frac{N}{\cos^3 h}$ which has hitherto been used to determine the cutter number. The use of this expression has been based on the idea that the cutting profile matches the tooth surface in a section at right angles to the teeth, but we have seen that the cutter body and the tooth surface cannot fit each other in a normal section. They contact along finishing lines F and F' and this fact causes the presence of the second member of the expression in equation 2.

The amount of this second member, $P \times D_c \times \tan^3 h$, depends upon D_c and the larger D_c, the larger N_c will become, the cutting profile getting flatter. When the

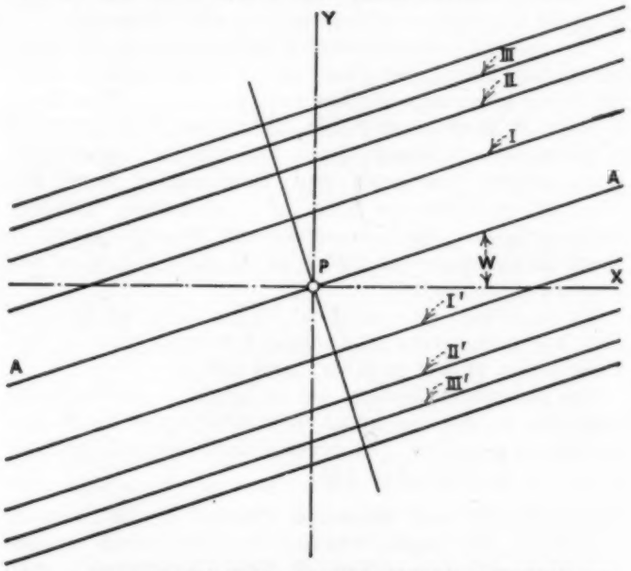


FIG. 4—TOPOGRAPHICAL MAP OF SMALL PORTION OF HELICAL TOOTH SURFACE ABOUT P

cutter diameter is very large compared with the pitch of the teeth, the profile of the required cutter is very nearly a straight line.

The application of the formula is exceedingly simple as is shown by the following examples:

Example 1—$N = 6$, $P = 6$, $h = 45$ deg., and $D_c = 3$ in.

$$N_c = \frac{6}{0.353} + 6 \times 3 \times 1 = 17 + 18 = 35.$$

This result shows that a cutter corresponding to 35 teeth must be used. In other words, a No. 3 cutter will produce the desired tooth profile.

Example 2—$N = 4$, $P = 6$, $h = 60$ deg., and $D_c = 3$ in. The teeth in this gear will be inclined at an angle of 60 deg. with respect to straight teeth, giving the pinion the appearance of a worm. Such a pinion might be used to run with a mating gear, the axis of the gear being at right angles to the axis of the pinion.

$$N_c = 4/0.125 + 6 \times 3 \times 3 = 32 + 54 = 86.$$

These two examples show that the new formula may produce results quite different than those of the formula which has hitherto been in use. In the first example N_c would be 17 according to the old formula instead of 35, and 32 instead of 86 in the second example. The

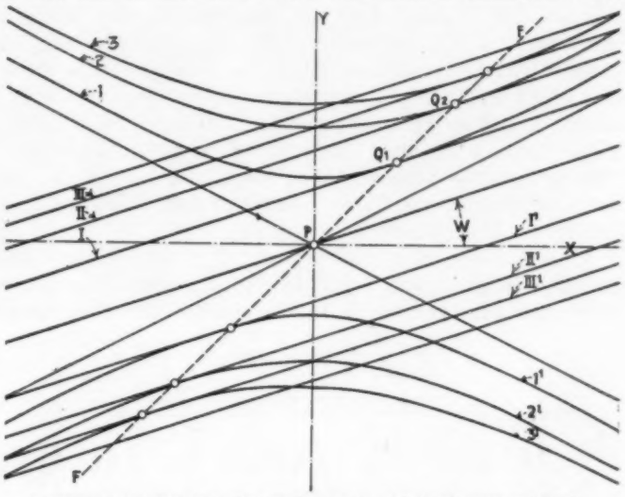


FIG. 5—MAPS OF CUTTER AND TOOTH SURFACES SUPERPOSED

difference is smaller with smaller values of h, but the formula is well worth consideration, since it is based upon strict mathematical principles. It will give better results, and it is simple as could be desired.

From formula (1) an equation which is useful in thread milling is also found.

$$R' = \frac{R \sin \alpha}{\cos^3 h} + R_c \sin \alpha \tan^3 h \qquad (3)$$

in which

R' = distance GO of the cutter, Fig. 1, and equals the radius of curvature of the cutter plus the distance PO
R = pitch radius of the gear
R_c = pitch radius of the cutter.

Reference to this formula will be made in a later article.

Embrittlement of Malleable Cast Iron Resulting from Heat Treatment

Recent investigations have shown that commercial malleable iron is often embrittled by quenching from certain temperatures in the "blue-heat" range, an abstract of Technologic Papers of the Bureau of Standards, No. 245, by Leslie H. Marshall on this subject states. The low shock resistance of such material after hot-dip galvanizing has brought this fact to the front. The present study of the problem showed that the magnitude of the Izod impact test was used as a convenient means for measuring the effect. The embrittlement was limited to a fairly definite range of quenching temperatures. Aging after treatment did not affect the results. The rate of cooling from the blue-heat range was important. If the malleable iron were slowly cooled instead of quenched from these temperatures, the impact resistance was much higher. It was also found that the upper limit of the embrittlement zone lay a few hundred degrees Fahrenheit below the critical point. Quenching from temperatures in this intervening zone increased the impact-resistance of the iron and made it immune to the blue-heat deterioration.

Piston Pins and End Plugs

BY FRED H. COLVIN
Editor, *American Machinist*

THE making of piston pins and the plugs that fit over the ends, for the engines of the Wright Aeronautical Co., Paterson, N. J., involves several details which are of interest. The pins are made from bar stock in National Acme automatics, the first operations being to turn the outside to 1.403 in., to drill a ¾-in. hole 5 in. deep, and cut off to 4⅞ in. in length. The drilling is done in three steps, the first being 1¾ in. and the second 3½ in., the third drill completing the hole. The outside tolerance is ±0.002 inch.

The pins are next carburized, after which they are chucked in soft jaws bored to suit, the ends faced and the holes enlarged to ⅞ in. to remove the case from

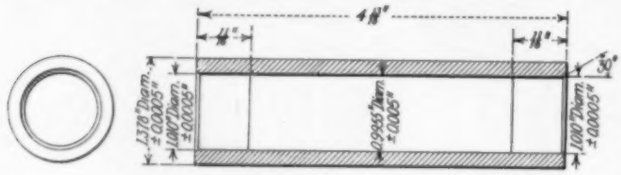


Fig. 1

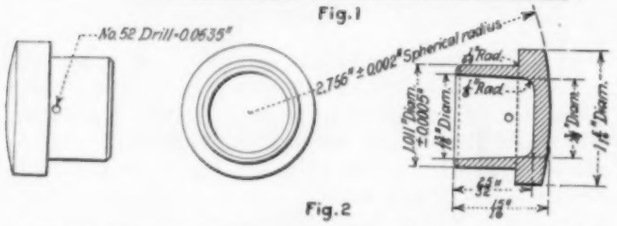


Fig. 2

FIG. 1—DETAILS OF PISTON PIN. FIG. 2—DETAILS OF PISTON-PIN PLUG

the inside. The ends of the holes are reamed to 1.01 in., with a tolerance of ± 0.0005 in., the ends chamfered and the pins hardened. Sandblasting follows, only the chamfered ends which act as centers being excepted.

Then a spot for making a scleroscope test is ground the whole length of the pin on a disk wheel. The test must read between 70 and 90. The hole is next polished to remove the scale, after which the outside is rough ground to 1.384 ±0.001 in. The ends are ground, 4 pins at once, to a length of 4⅛ in., grinding equal amounts from each end and getting the ends square with the outside diameter. Each end is then ground as shown in Fig. 1 after which the outside is ground to finish size, buffed to remove the sharp edges, inspected and wrapped in a waxed paper sheet, measuring 6x6 in. The pins are then ready for stock.

The requirements are that the inside be left soft and must be smooth so as not to afford a starting place for small cracks. The inside and outside diameters must be concentric within 0.010 in. and the ends square with outside within 0.003 in. The heat treating must give maximum refinement of the core with proper refinement and hardness of the case. The case is from 0.030 to 0.060 in. thick.

The piston-pin plug fits into the end of the piston pin and into a counterbore in the piston itself. Its object is to prevent the piston pin from ever making contact with the cylinder wall, for the piston pin is of the floating type. The plugs are of bronze and are made from cast rods that are first centered at each end and then turned to 1⅛ in. diameter in an engine lathe, using two tools.

The bars then go to a Warner & Swasey turret lathe, the hole is drilled, the outside cut down with a box tool, and the spherical head rough formed, allowing 0.005 in. on the back of the head for grinding. The dimensions are shown in detail in Fig. 2. Two small holes, No. 52 or 0.0635 in., are drilled in the sides. The spherical surface is then finished, the smaller diameter and the back of the head ground to size.

Book Reviews

Transactions, Vol. II., 1921-22, of the Newcomen Society. 164 pages, 7¼x10 in. With 22 plates and other illustrations. Printed for the Society by The Courier Press, Leamington Spa, London. Price 20 shillings.

On the cover of the second volume of transactions of the Newcomen Society appears its new emblem which represents a heraldic griffin, symbolic of vigilance, looking backward but moving forward. The Latin motto may be freely translated, "Mindful of what has been done, we strive at the same time after the things yet to be done." It might be said for the benefit of those who are not familiar with the purposes of the Newcomen Society that it was organized for the study of the history of engineering and technology.

The present volume contains the papers on engineering history read before the Society since October, 1921. The more important of these are as follows: The Early History of Mechanical Handling Devices, The Liverpool & Manchester Railway, Greek and Roman Engineering Instruments, Mechanics and Engineering from the Time of Aristotle to That of Archimedes, Timothy Hackworth and the Locomotive and The Centenary of Naval Engineering (A review of the early history of the English steam navy).

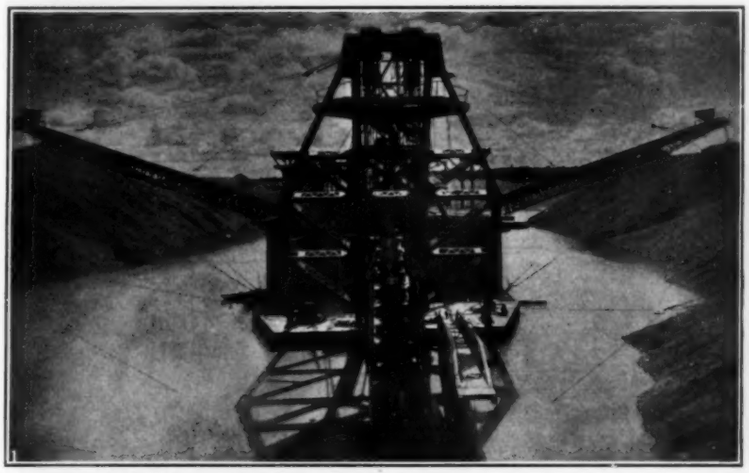
There is also an analytical bibliography of the history of engineering and applied science from 1900-1920, a list of the members and the usual reports.

The Newcomen Society aspires to be an international body and to this end hopes to number more Americans among its members. At present there are only ten out of a total enrollment of 125.

Departmental and Standard Costs. By William S. Kemp, 85 pages, 7¾x10½ in. Published by the National Association of Cost Accountants, 130 West 42nd Street, New York City. Price to members $2, non-members $4.

A very concise description of the way in which departmental and standard costs can be handled in almost any factory. The system described is designed with the specific intention of not only functioning properly but of fitting into a business without friction or duplication. The method outlined takes into consideration buildings, various productive departments, heat, power, compensation and all the other factors which go to make up expenses of a manufacturing business. Examples of different forms are given, including pages from books actually used by real concerns. It shows many factors such as pro-rating heating costs to different departments, rental values of machines, etc. With the increasing interest in modern accounting methods such a book should be of value in almost any manufacturing plant.

One drawback to many proposed systems is the complicated forms and the keeping of records which are never used. This seems to be avoided in the methods suggested.



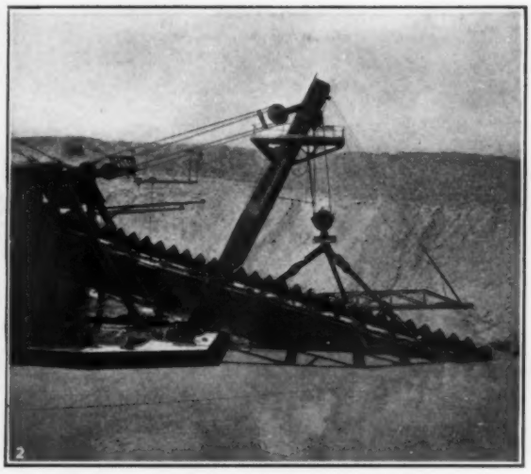


FIG. 1—GOLD DREDGE AT WORK. FIG. 2—THE DIGGING END OF THE DREDGE

Gold Dredges and Some of Their Repairs

SPECIAL CORRESPONDENCE

A few details of a type of machine little known east of the Pacific Coast—Repairing manganese steel buckets and replacing them in the chain

GOLD dredges are peculiar animals. Beginning with a huge hull on the lines of a scow or flat bottom float, built of heavy steel plate, they carry a large power plant which drives the chain of dredging buckets, the revolving screens which sort the material, the gold reclaiming mechanism, and finally the long conveying belts which carry the rock and surplus material out the back to spill it into the water behind. In this way, the dredge makes and moves its own pond as it travels, as can be seen in Fig. 1.

One of the dredges at Hammonton, Calif., having buckets of 18½-cu.ft. capacity, is shown in Figs. 1 and 2. During the month of May, 1923, one of these dredges handled over 17,000 cu.yd. per day, which is believed to be a record. The dredges are capable of digging from 82 to 85 ft. below water level, and piling up a bank 20 ft. above water level at the sides and rear.

The chain of dredge buckets in front is moved slowly from side to side by swinging the dredge itself. In this way, the buckets feed their way forward into the solid earth, and as all of their digging, except the gold which remains in the extracting mechanism, goes out at the back end, the water way remains practically the same size at all times. And the end of the dredging operation leaves the dredge stranded, perhaps miles from where it started.

The interesting part of the operation is, that while it does not make two grains of gold where one grew before, it is extracting large quantities of gold from the very districts which were supposed to be worked out years ago by the old hydraulic, and similar methods. It is claimed that by means of the gold dredge, these abandoned districts are yielding more gold than ever before.

As may be imagined, this kind of digging is very hard on the dredge buckets. On this account, the buckets are made with separate lips which can be replaced after they have worn beyond the economical limit. Both the bucket itself and the separate lip are made of manganese steel castings, all the holes for riveting being cored, as drilling is practically out of the question. The buckets weigh from 3,600 to 3,800 lb., while the weight of the lips varies from 400 to 600 lb. The pins by which they are connected together and formed into a chain weigh about 200 lb., making the total weight about 4,800 lb. per complete bucket.

When it is remembered that the large dredges carry 100 of these buckets in the chain, it will be seen that the total load of 480,000 lb., or 240 tons, requires very heavy machinery for its handling. And when approximately half the buckets are loaded with rock on their way to the back end of the dredge the amount of power required can be better appreciated. On most of the modern dredges, the power is supplied by electric motors, current being obtained either from local power plants, from sub-stations of high tension transmission lines, or from plants of the dredging companies.

The general appearance of the dredges themselves is shown in Figs. 1 and 2. Fig. 3 shows one of the buckets which has just been repaired by having a new manganese lip riveted into place. In Fig. 4 is shown the method of removing the rivets which hold the old lip, by means of a pneumatic "gun." The heads of the rivets are first knocked off, and then the large air gun shown is brought into position so as to drive out the shanks of the rivets. It will be noted that the gun is chained to the bucket being operated on, in order to make the blow as effective as possible.

FIG. 3—A REPAIRED DREDGE BUCKET

FIG. 4—KNOCKING OUT RIVETS WITH AN AIR GUN

The equipment for riveting on the new lips is shown in Fig. 5. The bucket to be riveted is brought within range of the jib crane shown, so that the portable compressed-air riveter can be brought to position for riveting on the new lip. The riveter hangs on trunnions and can be swung into any desired position to drive rivets at all the various angles. The rivet heating forge is conveniently placed, and the combination allows the dredge buckets to be repaired quite rapidly.

FIG. 5—THE RIVETING OUTFIT

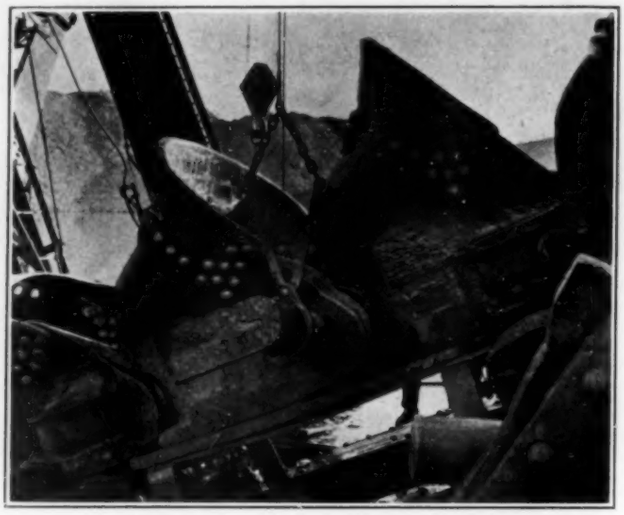


FIG. 6—REPLACING A BUCKET IN THE CHAIN

The method of replacing a bucket in the dredge chain is shown in Fig. 6. Here a bucket with a new lip riveted in place, is being supported by a sort of platform which rests on the huge boom arm and holds the new bucket in line with the others. The heavy pin which connects it to the bucket in front, is just being put into place with the aid of tongs and a hoist. The pin has a long head on one end, the head fitting into the recess shown, which prevents the pin both from turning and working out.

These views are from one of the large dredging companies near Marysville, Calif. The dredge was built by the Yuba Mfg. Co., also of Marysville.

Carbon Tool Steel Specifications

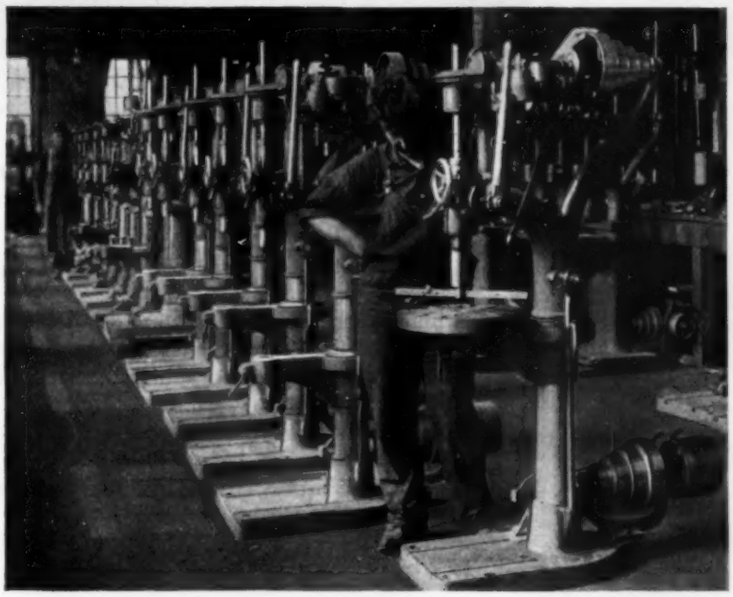
The specifications given herewith are from the 1923 Book of Standards of the American Society for Testing Materials and cover three classes of carbon tool steel, determined by the chemical composition.

The steel shall be made by either or both the following processes: Crucible or electric, with the exception of Class C, which may also be made by the open-hearth process.

The steel shall conform to the following requirements as to chemical composition:

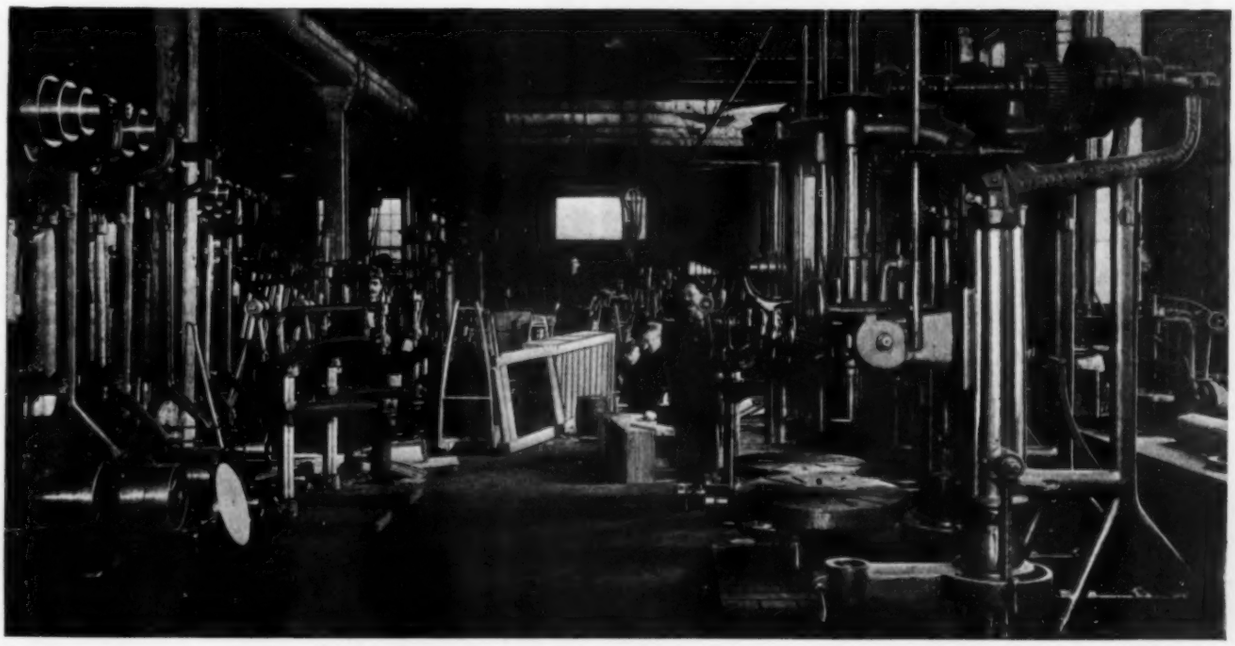
Elements Considered	Class A	Class B.	Class C
Carbon, per cent.....	The percentage of carbon may vary by ranges of 0.10 per cent with rejection limits plus or minus 0.025 per cent.	(Same as Class A)	(Same as Class A)
Manganese, max., per cent.....	0.40	0.45	0.60
Phosphorus, max., per cent.....	0.02	0.025	0.035
Sulphur, max., per cent..	0.025	0.035	0.04
Silicon max., per cent....	0.35	0.35	0.25

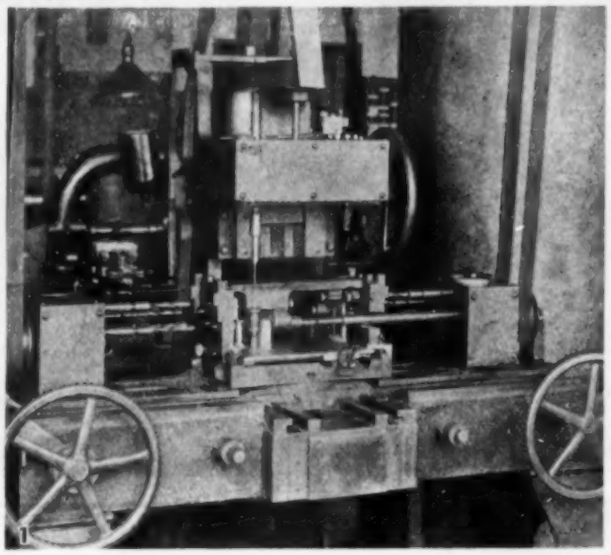
As an illustration, tool steel may be ordered with a carbon range of from 0.60 to 0.70 per cent, with rejection limits of 0.575 and 0.725 per cent, or from 0.75 to 0.85 per cent with rejection of 0.725 and 0.875 per cent.

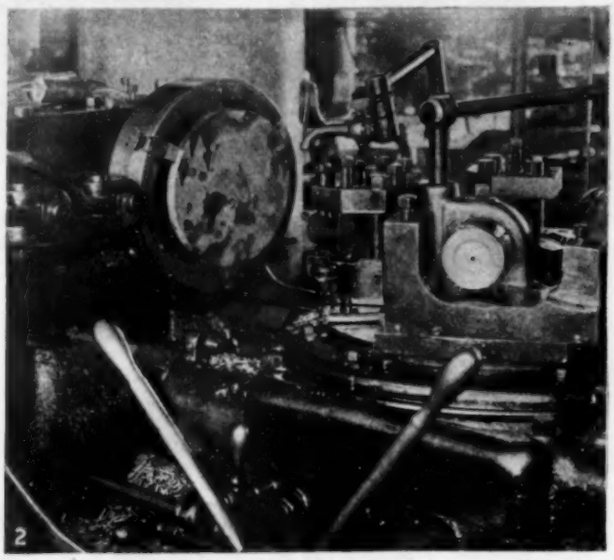


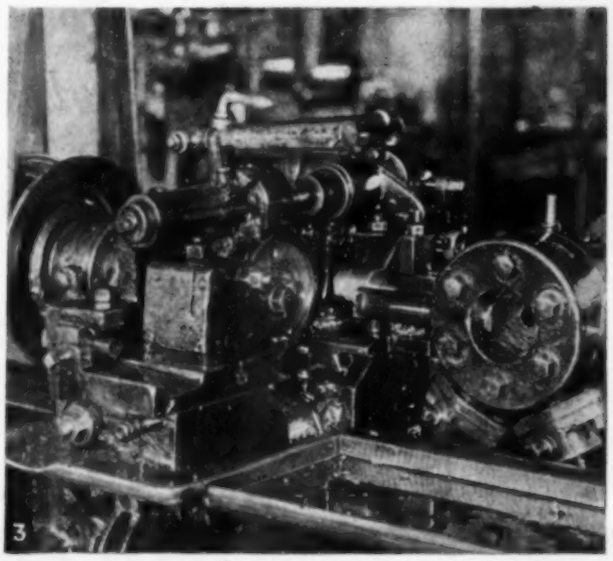
Where Machine Tools Are Made

Hoefer Manufacturing Co.
Freeport, Illinois
Founded 1892









Hatching Tin the Edison

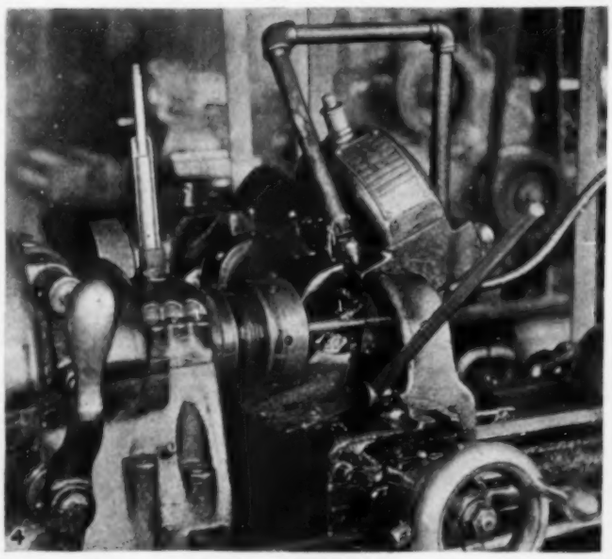
1—A home-made machine drilling ten holes in an Ediphone top plate

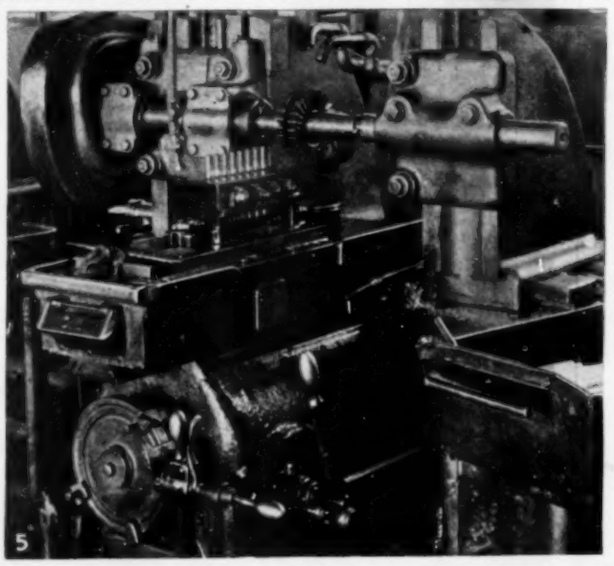
2—Making a mold plate for a disk record on a J. & L. turret lathe

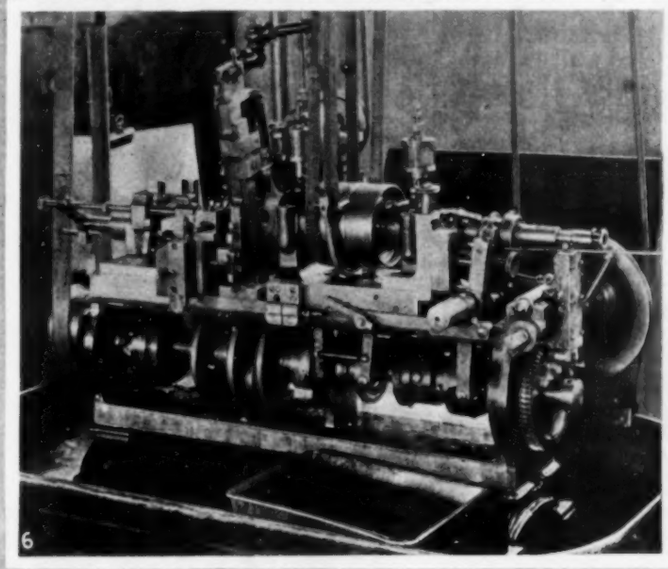
3—A Brown & Sharpe automatic screw machine chasing rack driving worms

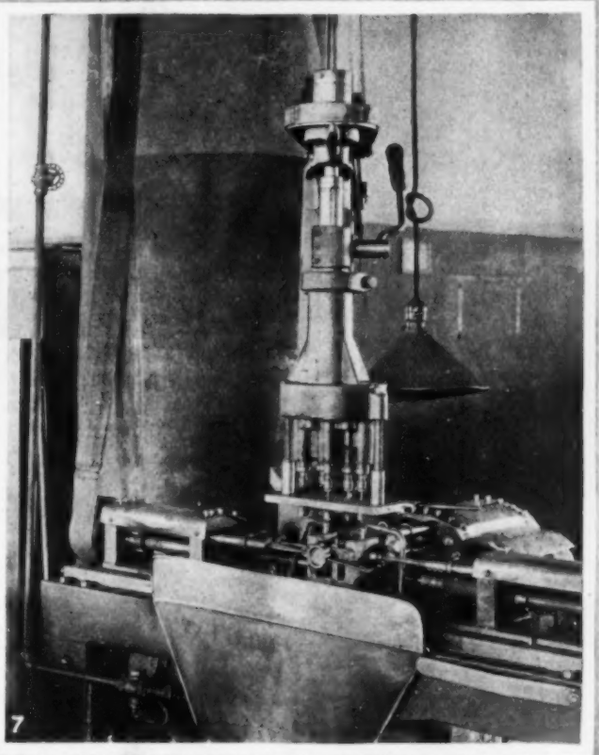
4—A Pratt & Whitney thread milling machine operating on a turn-table spindle

5—Straddle milling horn lift-shafts on a Pratt & Whitney automatic milling machine









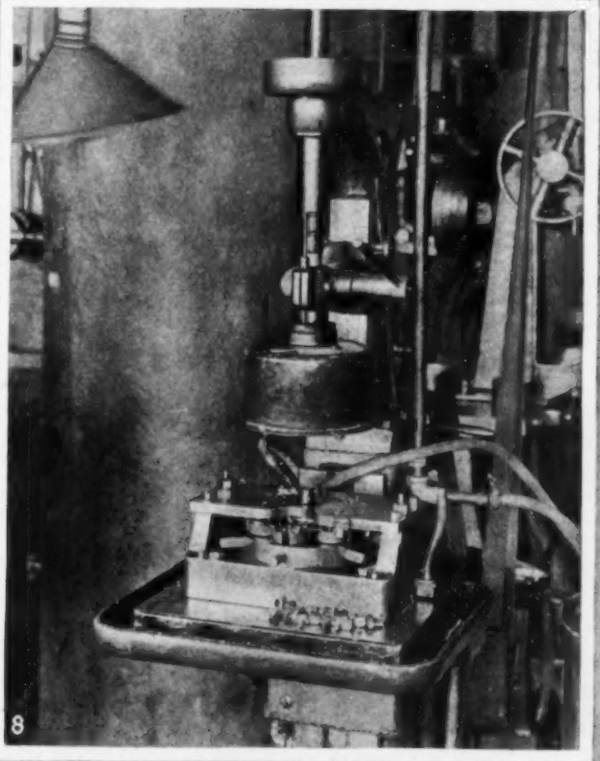
Stenographers at Works

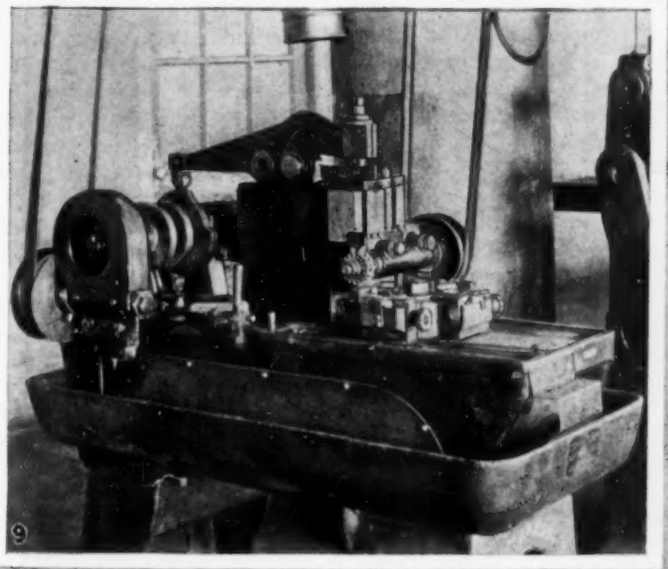
6—Stahley automatic screw machine with the cover removed from the bed

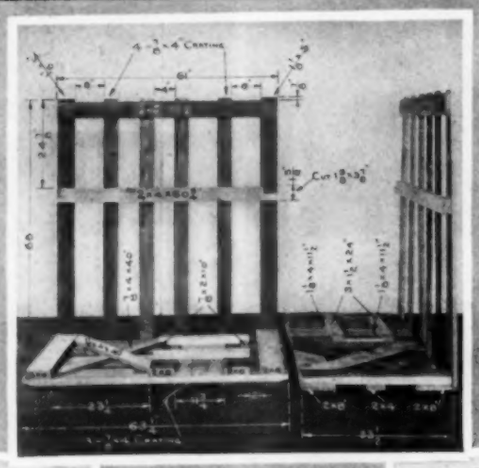
7—A special machine drilling eight holes in a barrel-shaft support bracket

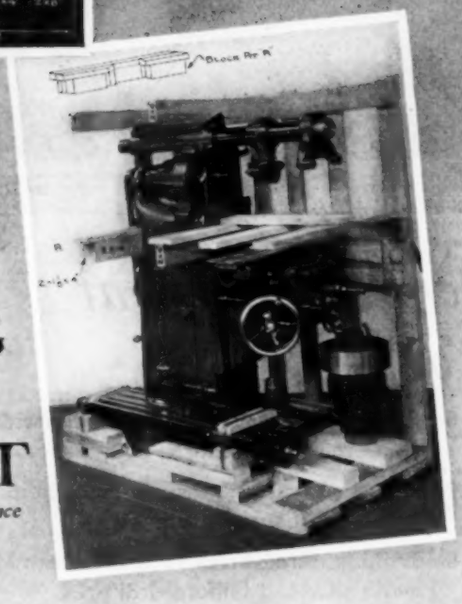
8—Drilling three holes in a disk reproducer swivel; Leland-Gifford drill press

9—Bilton automatic milling machine finishing lugs on disk reproducer weights







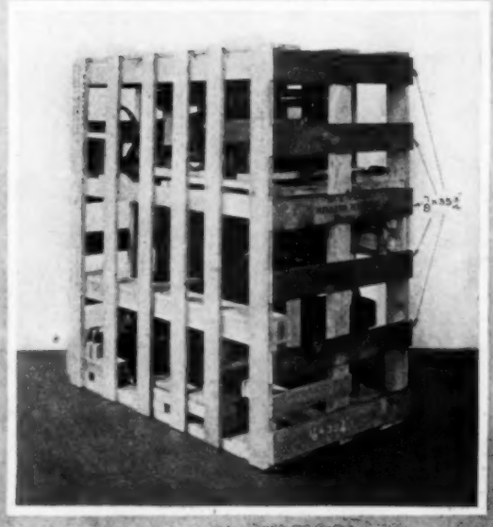


PACKING *for* SHIPMENT

Brown & Sharpe Mfg. Co., Providence

These views show the steps taken and the material used in crating a No. 2 Plain Milling Machine. They are issued instead of blueprints to the men doing the work.

The methods employed are largely the result of a study made by one of the representatives of the company at the Forest Products Laboratories, Madison, Wisconsin.



Development of Machine Tools in New England

By GUY HUBBARD

The ninth article—The Robbins & Lawrence shop—Making rifles for the Government—Plant for building cars—Manufacture of the Sharps rifle—Armory built in Hartford

IN THE first part of Chapter XV of his "English and American Tool Builders," Prof. Joseph W. Roe says: "—— the old Robbins & Lawrence shop, at Windsor, Vt., in the back woods of northern New England, deserves a special chapter. When built, it was miles away from a railroad. It was never large, and the wheels of the original shop have long since ceased to turn, but few plants have had so great an influence on American manufacturing." A picture of this shop is shown in Fig. 50.

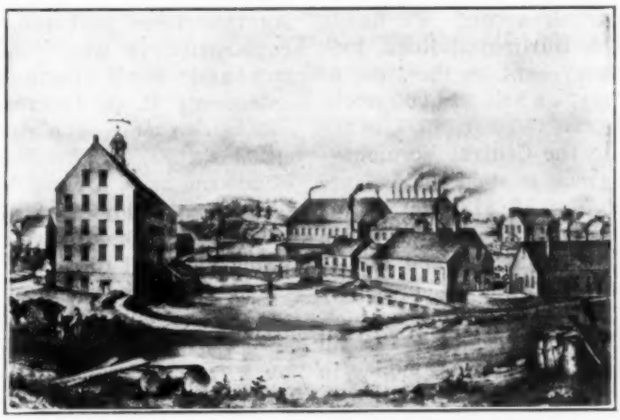


FIG. 50—PLANT OF THE ROBBINS & LAWRENCE CO., WINDSOR, VT., 1849

I will add to Prof. Roe's statement that the manner in which this famous industry suddenly developed from the obscure country gun shop of Kendall & Lawrence was no less remarkable than was its later influence. The story is best told by Richard S. Lawrence himself, as follows:

"One day in the winter of 1844, Samuel E. Robbins came into our shop and spoke of the Government asking for bids for rifles. We talked the matter over and decided to put in a bid for the rifles at $10.90 each, appendages extra. This was 10 cents below any other bid, and the contract for 10,000 rifles was awarded to Robbins, Kendall & Lawrence. This was at the beginning of the Mexican war and the Government was very much in need of rifles, so we made a contract to finish the job in three years.

"Guns were not made very fast in those days and we had nothing to start with—neither buildings nor capital—and we had the opposition from all the other Government contractors, who said that we could never do the work. We did have nerve and pluck, however, and were determined to carry out that contract. The real work fell on me, Mr. Robbins not being a mechanic, and Mr. Kendall not exactly calculated for such nice work—which made it hard for me. We went to work with a determined will, bought land, built factories, bought and built machinery, and started the business in good shape.

"About the time of the completion of this first contract Mr. Robbins and I bought out Mr. Kendall. At that time Mr. Robbins said to me, 'Lawrence, if it had not been for you as a mechanic, and for your attention to business, we could never go along with the heavy outlay on our hands.'

"We finished the first contract eighteen months ahead of time and made a nice thing out of it. We went on to Washington, and Gen. Talcott of the Ordnance Board told us that ours was the only gun contract ever finished within the contract time. The General said: 'What do you want now—you have done well and finished?' We replied, 'We want another contract for rifles.'

"'Come with me over to the office of Secretary of War Marcy,' said the General. Gen. Talcott told Secretary Marcy all about our work and wants, and the Secretary said, 'I will see about it.' On our return to Gen. Talcott's office he saw that we were a little disappointed, and he said, 'Go right home and a contract will be sent to you in a few days.' This contract came for 15,000 rifles, which placed us well above board.

"In manufacturing Government rifles a loss of about thirty-eight per cent was usual, this percentage being condemned for poor material or workmanship. In 1849-50 the great California gold rush excitement was raging, and guns were in such demand that we sold all our second-quality work, with good mixed in—anything to make up a working gun—for the full price of good guns. This was a great relief in every way and things looked very bright.

"Before 1849 we were very unfortunately situated about freight, as no railroad passed through Windsor, and most of our freight had to come from Boston by team. In 1849 the railroad was built through Windsor which put the market much to our advantage, and the railway contractor, Sewel F. Belknap, came to us and wanted to start the car business with us. He led us to believe that he could control all the railroad car work in that section, so we went into the business. He put in $20,000 as a silent partner and we (as the Windsor Car & Rifle Company, incorporated on Novem-

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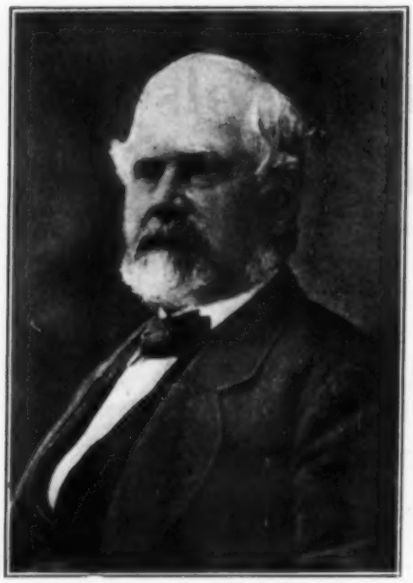


FIG. 51—RICHARD S. LAWRENCE

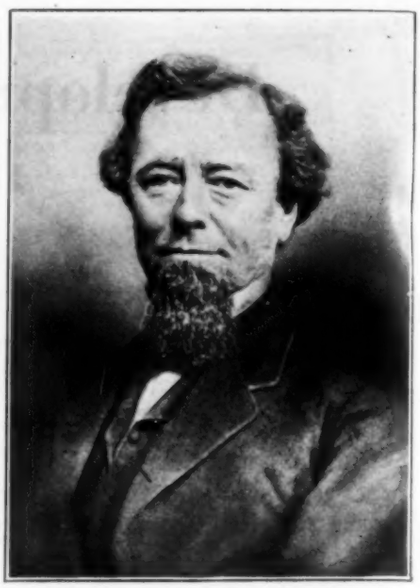


FIG. 52—SAMUEL E. ROBBINS

ber 7, 1849, the name being changed to the Robbins & Lawrence Company in 1850) went to a large outlay. It was at this time that I introduced the first machine for pressing on car wheels on a taper, without splining or keying—an invention which has since been adopted by all railroad shops. I made a great mistake in not securing a patent on on this. About the time we finished the first car, Mr. Belknap had a quarrel with the president of the road, and as a result we could not sell a car. We finally sold the cars to the Rutland & Burlington Road, took stock in payment and lost every cent to the tune of $40,000. Later, in the same way, we sold $14,000 worth to the Boston, Concord & Montreal; $5,000 worth to the Sullivan; and $75,000 worth to the Central Vermont—losing all of it. It was a great mistake going into this business, and this total loss of $134,000 was a drain on the gun work and cramped us terribly. On June 19, 1849, Mr. Belknap died suddenly, and in settling his estate his executors brought a charge of $105,000 against Robbins & Lawrence, as money lent. I knew nothing about this, but as near as I could learn Mr. Belknap and Mr. Robbins lost this money in stocks in Boston. We had to pay this charge, which made a total loss of $239,000—all paid up out of the gun business."

In Figs. 51 and 52 are shown portraits of Richard S. Lawrence and Samuel E. Robbins, while in Fig. 53 is a reproduction of a stock certificate of the Robbins & Lawrence Company.

When, on February 18, 1845, Robbins, Kendall & Lawrence took its first contract for the 10,000 interchangeable Harper's Ferry type U. S. Army rifles, shown in Fig. 54, its plant was nothing more than a small country jobbing shop located in a one-story wooden building on the north bank of Mill Brook, the same one formerly used by the American Hydraulic Co. The equipment consisted of only a few crude machine tools, most of which had been inherited from their predecessors, the National Hydraulic Company and N. Kendall & Company, and the force consisted of some twenty-five local workmen—also mostly inherited from the older concerns. By dint of advertising, both printed and by word of mouth, the company rapidly swelled its force to more than one hundred and fifty — recruiting not only most of the laborers and skilled mechanics of the Windsor region, but also many experts from such centers as the shops of Eli Whitney, Silver & Gay, Amoskeag, and the National Armories at Springfield and Harper's Ferry. As this force gathered, new buildings were rapidly constructed in which these mechanics went to work to build newly designed machinery under superintendents R. S. Lawrence, Frederick W. Howe and Henry D. Stone—who vigorously pushed the work.

Meanwhile, in April, 1846, the construction of a handsome brick armory was begun on the south side of Mill Brook, opposite the original gun and machine shops. By the time this Windsor Armory (which is today the sole survivor of the original works) was completed a full equipment of highly developed gun machinery was ready to be installed therein, so that the interchangeable manufacture of the rifles was carried on without delay by the same workmen who had built the machinery. In this case at least, there appeared to advantage the old-fashioned "all around mechanics" who were capable of turning their hands to any sort of mechanical work. An idea of the rapid growth and extent of this new Windsor industry may be gained by the following description from the *Vermont Journal* of Feb. 16, 1849—less than three years after ground was broken for the Armory:

"Up to this date nine edifices in all have been erected and put in use, among which is a rifle-factory and machine-shop, a brick structure 100 feet by 40 and 3½ stories; the car shop, a wooden building of about the same length and breadth, but of less height; 3 blacksmith shops of brick, of smaller size, containing 20 forges and 5 triphammers; and 4 other buildings of various dimensions, all of which, with the apparatus required for the several species and branches of work, cost the sum of 115,000 dollars. The foundry (carried on by Lycurgus

Courtesy of Frank R. Lawrence

FIG. 53—STOCK CERTIFICATE OF THE ROBBINS & LAWRENCE COMPANY

C. Hammond and Francis Draper) is a tall structure of brick, 80 by 50 feet, the building of which was commenced in September, 1847, and which cost between three and four thousand dollars."

It may be mentioned that as a result of the unfortunate car-building venture, the machine shops were connected by a long spur track extending from the main line of the railway, being used for freight purposes for many years after the abandonment of the car business.

As may well be imagined, this sudden industrial expansion in the little village of Windsor (whose fixed population was about 2,500) made the housing situation acute and resulted in much residence building. The *Vermont Journal* of December 1, 1849, says:

"Twenty-four neat cottages have been erected during the past spring and summer. Old dwellings have been renewed, shops and buildings of divers sorts have sprung up to our amazement. New streets have been opened, and shanties are found, where we little looked for them a few years since. In the south part of the village, a new street has been opened on an elevated plain just southwest of the Armory, called Buena Vista, (this name still persists, as an echo of the Mexican War which brought this fine residential district into being) on which are several handsome dwellings. Others are to be erected, we understand, in the coming spring. Every mechanic and laborer of any sort has been in requisition — and yet the want of convenient dwelling houses, to say nothing of shops, etc., is still very pressing."

To this it may be added that the Robbins & Lawrence Company rather went ahead of its times by building and maintaining a large four-story lodging and boarding house for the convenience of its single workmen and those without homes in Windsor—the board and room rent being deducted at the office of the company.

In 1850, new buildings were built and new machinery installed for the manufacture of that direct ancestor of the Winchester rifle—the Jennings repeater—for Courtlandt C. Palmer. In that same year Robbins & Lawrence also took the step which had so great an influence upon the industrial life of Hartford, Conn., in taking up the development and manufacture of the Sharps breech loading rifle, famed for its performance.

FIG. 55—SHARPS CAVALRY CARBINE
(From the author's collection)

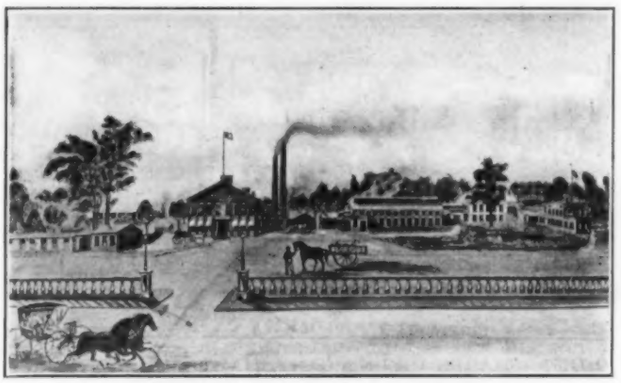


FIG. 56—SHARPS RIFLE PLANT, HARTFORD, CONN., 1853. FROM WHAT IS NOW CAPITOL AVENUE

Christian Sharps, who had been a workman under that early exponent of the interchangeable system, Captain John Harris Hall, at Harper's Ferry Armory, was inspired by Capt. Hall's breech loading rifle to invent his famous Sharps breech loading rifle—which he patented September 12, 1848 at Cincinnati.

After having experimental models built by various gunsmiths, Mr. Sharps in 1850 brought his invention to the Robbins & Lawrence Co. at Windsor, who contracted to perfect the gun and to build 5,000 of them on the interchangeable system, in the form of cavalry carbines, as shown in Fig. 55. During his experiments upon the Jennings repeater, Mr. Lawrence had invented the lubricated bullet, and the application of this invention to the Sharps sliding breech rifle, for the first time, made the rifle entirely practical and its success was thereby assured.

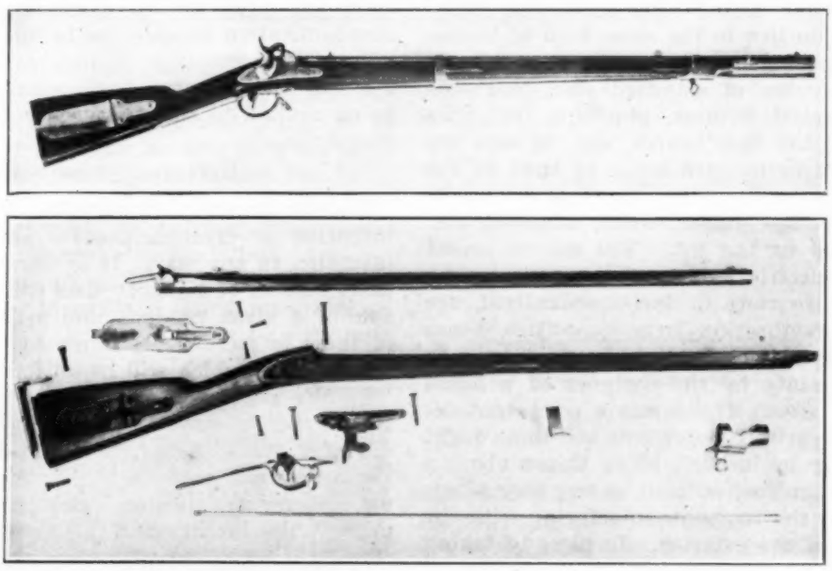


FIG. 54—ROBBINS, KENDALL & LAWRENCE RIFLE OF 1854
(From the author's collection)

The building of the first 5,000 rifles required much space and new machinery at Windsor, where the shops were already crowded to capacity, and when an additional contract for 15,000 Sharps carbines and rifles was received, the Robbins & Lawrence Co. decided to build in the more accessible city of Hartford, Conn. a separate plant for the manufacture of these popular breech loading arms.

To make this possible, a holding company for the Sharps patents was organized at Hartford in 1851, having a capital of $100,000; with John C. Palmer as president, George H. Penfield as sales agent, Christian Sharps as engineer, and Richard S. Lawrence as master armorer and superintendent. This so-called Sharps Rifle Manufacturing Co. advanced $40,000 to the Robbins & Lawrence Co. which purchased a twenty-five acre tract of pasture land bounded on the North and

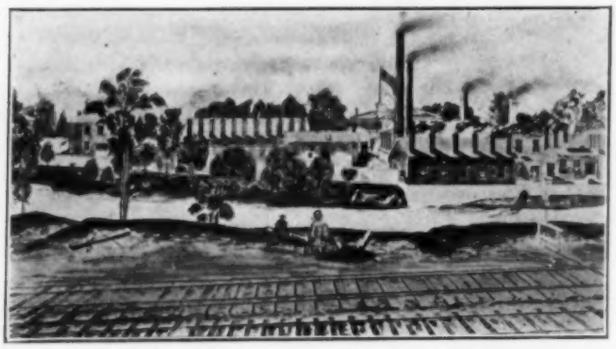


FIG. 57—SHARPS RIFLE PLANT, HARTFORD, CONN., 1853. FROM N. Y., N. H., & H. RAILWAY
(From a painting by C. S. Porter)

West by Little River (now Park River), on the East by the land of Trinity College (now Bushnell Park, the site of the State Capitol), and on the South by a country road which is today the busy Capitol Avenue. Under the plan and direction of Richard S. Lawrence, who removed to Hartford in 1852, the Windsor Co. erected in the midst of this tract, a fine two-story brick armory, 160x60 ft. with an L containing a forge shop, views of which are given in Figs. 56 and 57. In the meantime the mechanical equipment was built at Windsor and as soon as it was installed about two hundred and fifty mechanics were set to work. This was the second large machinery industry to locate in Hartford (Colonel Samuel Colt having established his revolver manufactory there three years before) and it opened up what is today the Capitol Avenue industrial district —one of the busiest in the country. These pastures of the fifties are today covered by the great plants of such concerns as the Pratt & Whitney Co., the Hartford Machine Screw Co., Hart & Hegeman, and the Underwood Typewriter Co. Of the history of the Sharps Rifle Manufacturing Co. more will be said in the next article of this series, which will be published in an early issue.

Reducing the Cost of Building

THE layman often says, "Oh! you are one of those fellows that want us all to live in the same kind of houses and dress exactly alike." The answer is, "NO." We don't want you to live in the same kind of houses at all, but there is no good reason why there should not be a certain number of standard sizes to choose from so that electrical fixtures, plumbing, etc., can be factory made in the base boards, etc., to save the enormous cost of fitting up each house by hand on the job.

You do not expect the lumber, doors, windows, etc., to be made by hand on the job. You do not expect the plumbing and electric fixtures to be built on the job. These items are more or less standardized, are made by the manufacturer in large quantities, hence we can afford to have them. There is nothing to be gained in art or beauty by the designer of a house making rooms odd sizes. If he was a competent designer he would use certain proportions and these ought to certainly not vary by inches. Many things about a house could be standardized without in any way affecting the grouping of the rooms or interfering with the design and beauty of the exterior. In place of taking away the initiative of the architect, it allows him to save all the energy expended on trifles and apply it to the part of the house which he is originating or creating.

Variety Is the Spice of Life

Of course we don't want all clothes alike, but I for one would like to see the size of pockets standardized so that every time I buy a new suit I don't have to throw away my note books with valuable information because they won't go into pockets, or have to keep a variety of cigar or cigarette cases to fit the different sizes of pockets.

Another item which could be standardized without interfering with its usefulness is the bank check. At present there are all sizes from very small to very large, all containing about the same reading matter and all for the same purpose. It would be a great convenience if all bank checks were made of the same uniform size as our paper currency, enabling us to carry them in the same bill folder without folding them up.

I believe that the industries have nothing to fear from the most critical examination of the effect of standardization because the fixing of a standard is not necessarily permanent. Standards can be improved, and most of them except basic standards are constantly being revised to suit the needs of the public and the industries.

Defining Standardization

Standardization cannot take away the incentive to invention or creation because standardization is not invention in any way. It is merely the selection of a small number of styles or sizes which are the most suitable of a given product, and giving the specifications of these in measurable terms so that large quantities can be made which will be uniform.

In the standardizing of milk bottles, for example, the number of varieties was reduced from 49 to 9, the caps for the bottles from 10 to 1. This was simply the agreement between maker and user to eliminate unnecessary varieties and sizes and will not in any way prevent the invention of better milk containers.

Accounting for Low Cost of Production

If we were to ask ten men in the manufacturing world to account for the low price of some automobiles, nine of them would no doubt say it was due to the large number being made; that is, it was due to mass production. This is not the primary reason, but the result of another cause.

The real reason is standardization.

If only one car was being built, the parts need only fit together so they will function properly. If a large number were built in the same way very little economy would result from the large number outside of the saving in purchases. But if these parts are standardized so that their dimensions are uniform within certain limits, then the parts can be made to gages and templets in large quantities by machinery set to produce rapidly the exact sizes wanted. This being properly done, the work goes together without individual fitting. This is what reduces the cost of manufacture and enables one to buy repair parts that fit, at reasonable prices.

From address by Col. E. C. Peck, before the Cleveland Engineering Society.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

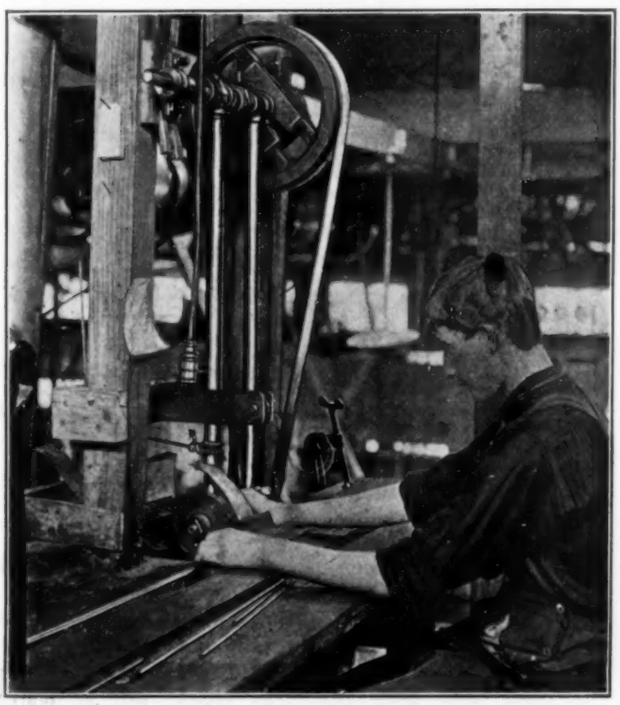
Cutting Brass Tubing

BY GEORGE EDGAR

Some shops waste so much time doing easy jobs in a hard way that one wonders how they can keep going. A few days ago I was in a shop where three men were employed, on as many turret lathes, in cutting up brass tubing, the length of which didn't have to be accurate within a eighth of an inch, nor did the ends have to be absolutely square or smooth. This tubing was ½, ¾ and 1 in. in diameter, 22, 20 and 18 gage respectively, and was all being cut into 3-in. lengths. Machined brass flanges were slipped over the ends of these pieces of tubing and soldered in place, a sort of jig being used to hold the parts so that the outer ends of the flanges would be the right distance apart. The solderers all had files with which they took off slight burrs from the ends of the pieces of tubing, for the cutoff tools were not made to do this automatically.

As I watched the time and money being thrown away by these inefficient methods, I thought of another shop where ½- to ¾-in. brass tubing was being cut to length with a swing-frame saw, as shown in the illustration. On the small sizes the operator cut two tubes at a time, and in the same time and on the same sizes of tubes, could probably cut twice as many pieces as the three men on the three turret lathes.

Of course, the apparatus shown is rather crude, but any good mechanic could easily make a real machine on the same plan, and a little care in feeding the tubing would give commercially accurate lengths with square ends and practically no burr. In any case a slight burr could be taken off easier on a wheel than with a file. Another advantage of the saw method is that short lengths of tubing may be used, and often short lengths may be purchased at a considerable less price than the longer ones.

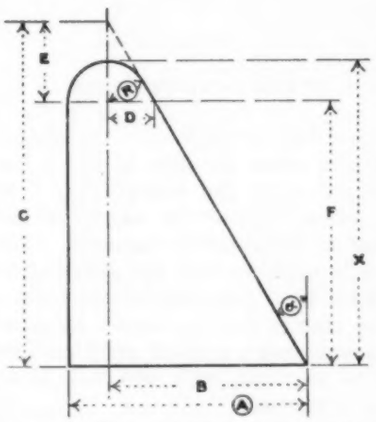


CUTTING BRASS TUBING ON A SWING SAW

A Trig Problem Often Met

BY EDWARD HELLER

One of the trigonometric problems that the man in the shop or drafting room invariably finds hard to solve is that in which two intersecting lines are connected by the arc of a circle. It seems that no matter how many of these problems one solves, the next one always has some catch that was not met with before. The difficulty seems to be in finding a starting point. Once that is gotten, the rest of it is easy.



PROBLEM OF FINDING THE DIMENSIONS OF THE GAGE

A problem of this nature was met by the writer in trying to get the dimension X in the profile of a gage. The dimensions R and A and the angle a were given. It will be seen at a glance that the making of the gage would be simplified very much if dimension X were found.

The problem was solved in the following manner:

$$B = A - R$$
$$C = B \cot a$$
$$D = \frac{R}{\cos a}$$
$$E = D \cot a = \frac{R \cot a}{\cos a}$$
$$F = C - E$$
$$X = F + R$$

The figures in this particular problem were $A = 1\frac{1}{2}$ in., $R = \frac{1}{4}$ in. and $a = 29$ degrees.

$$B = 1\tfrac{1}{2} - \tfrac{1}{4} = 1\tfrac{1}{4}$$
$$C = 1\tfrac{1}{4} \times 1.8040 = 2.255$$
$$D = \frac{\frac{1}{4}}{0.87462} = 0.2858$$
$$E = \frac{\frac{1}{4} \times 1.8040}{0.87462} = 0.5161$$
$$F = 2.255 - 0.5161 = 1.7389$$
$$X = 1.7389 + 0.250 = 1.9889 \text{ inches.}$$

These calculations give us everything that there is to know about the problem.

The Shaper as a Gear Generating Machine

By Joe V. Romig

The accompanying sketches show how an ordinary shaper may be rigged up as a gear generator when it is desired to cut a number of small gears to a more than usual degree of accuracy. A master-gear of the same size as the gears to be cut, a master-rack of corresponding characteristics, and a single tool of the same shape as a tooth of the rack, are required.

The essential features are shown in Fig. 1. A fixture,

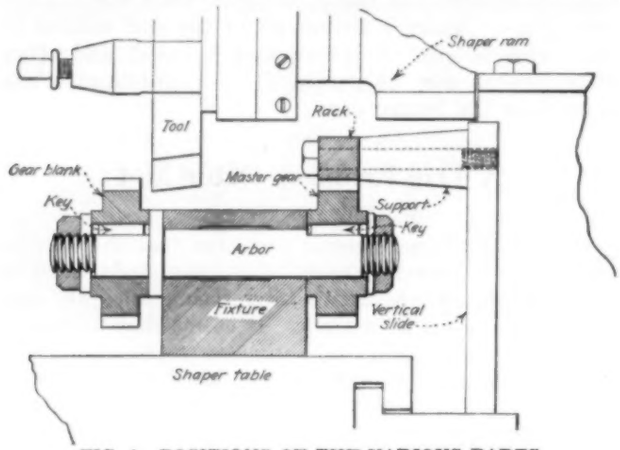


FIG. 1—POSITIONS OF THE VARIOUS PARTS

to be bolted or otherwise held to the top of the shaper table, carries a double-end arbor the axis of which lies parallel to the line of travel of the shaper ram. On the inner end of this arbor, toward the column of the shaper, the master-gear is permanently fastened. The outer end of the arbor is made to take the gear-blanks to be cut, which are held by a nut, supplemented by a key in the arbor. The master-rack is rigidly attached to the face of the shaper column in such position that the master-gear will be in mesh with and roll along under it as the table is traversed.

The meshing of the master-gear and rack may be adjusted by means of the vertical movement of the knee, and, once established so that the parts will mesh properly together without backlash, need not again be disturbed. The position of the cutting tool in the vertical slide of the shaper is quite independent of the movement of the knee and can be adjusted in any desired direction.

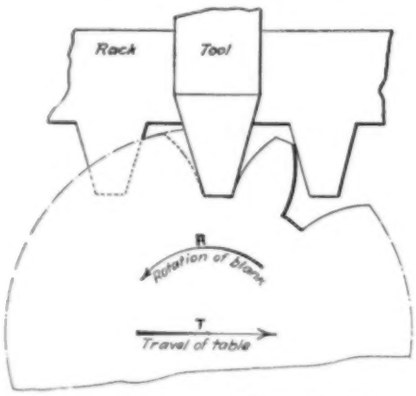


FIG. 2—HOW THE GEAR BLANK ROLLS UNDER THE TOOL

With the parts in proper relative position it will be seen that as the shaper table is traversed from side to side the gear blank will roll over the tool just as the master-gear rolls over the rack. Indeed, the tool represents one tooth of a rack in the path of the rolling gear blank. The action of the tool thus commences at the top of a tooth, planes downward over the face and flank, up and over the opposite side, and finishes at the top of the adjacent tooth.

Indexing is accomplished by traversing the table to one side until the master-gear rolls out of mesh with the rack, turning the gear one tooth or more, and returning the table with a different tooth of the master-gear in which position the master-gear is returned. In roughing a blank it is advisable to turn the master-gear nearly half way over each time in order that the heat generated in the blank by the cutting tool may be evenly distributed.

Any form of tooth may be produced by this means; the requisites being a master-gear and rack, and a correctly formed cutting tool. If an involute tooth is desired, the tool is not particularly difficult to produce, as the sides are straight lines. A clearance of about 8 deg. should be provided. The regular table feed can be used.

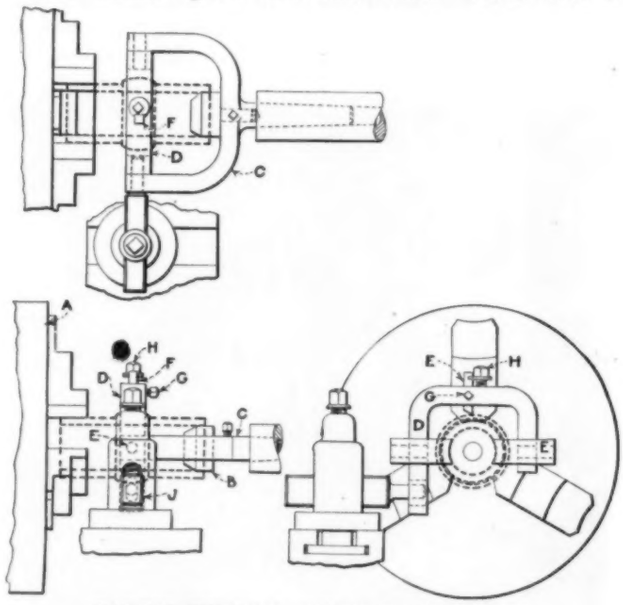
Hardened gears may be form ground with this rig by substituting a tool post grinder for the tool and setting the wheels to the proper relative position by trial. But one side of the tooth form can be ground at one setting; to grind the other side it is necessary to reset the wheel or turn the gear around on the arbor.

Boring and Turning Spherical Bearings —Discussion

By Harold J. Cramer

On page 267, Vol. 59, of the *American Machinist*, in an article under the title given above, Herbert F. Crawford shows a method of turning the seat radius of spherical bearings. This is only good for short bearings of large diameter, as he illustrated.

The method given herewith which works well on



RADIUS TURNING FIXTURE FOR LATHE

small bearings, has been used for some time in a manufacturing plant in which I have been employed.

The bearing is held in the lathe chuck *A*, and is supported and located by the plug *B*, which is inserted in the yoke *C*. This yoke is held in the tailstock with the arms level with the lathe center and of course parallel to the lathe bed.

The yoke D swings on the pivots E and carries the tool-bit F, which is held by a screw G. It is adjusted by the screw H. The center of the pivot E must be in line with the center of the bearing and must also be midway of the width of the seat on which the radius of the bearing is to be turned.

The distance from the point of the tool, from the pivot E, should measure the same as the required radius.

The lathe carriage is moved either by the power feed or by hand. The round pointed tool shank J, in the toolpost, operating in the slot in D, swings the yoke so as to give the tool a rotating movement on the pivots E.

This fixture will take the size bearing shown and also smaller sizes. When turning bearings with different bores, change plug B to fit bore. The radius is altered by adjusting the tool-bit F.

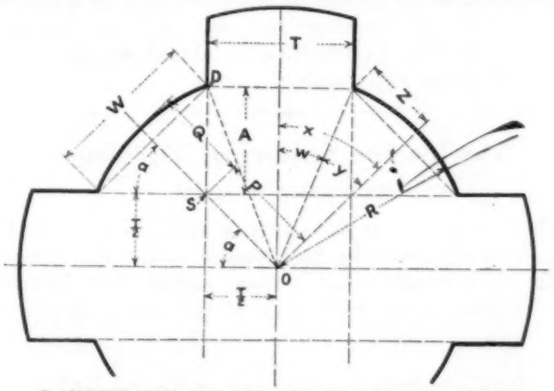
Formula for Finding Root Width of Splineways—Discussion

BY JACK DUTTON

There is an error in the discussion under the title of a "Formula for Finding Root Width of Splineways," by George E. Hodges on page 486 of the *American Machinist*. The formula as printed reads

$$W = 2C\left(R - \frac{\frac{T}{2}}{C}\right), \qquad (1)$$

where R is the root radius, T is the width of spline and C is the sin of a, which angle can be seen in the



LAYOUT FOR SPLINE SHAFT CALCULATIONS

accompanying illustration to be one-half the angle made by the center lines of the splines.

The value of P in the illustration is seen to be $\frac{T}{2} \div \sin a$; or as given in the article mentioned, $P = \frac{\frac{T}{2}}{C}$. This latter value when subtracted from R equals Q, or $\left(R - \frac{\frac{T}{2}}{C}\right)$. If Q were equal to A the formula previously printed would be correct, for then $\frac{\frac{W}{2}}{A} = C = \sin a$. Therefore, $\frac{W}{2} = CA$ and $W = 2CA$. If A equals $\left(R - \frac{\frac{T}{2}}{C}\right)$ then formula (1) is obtained.

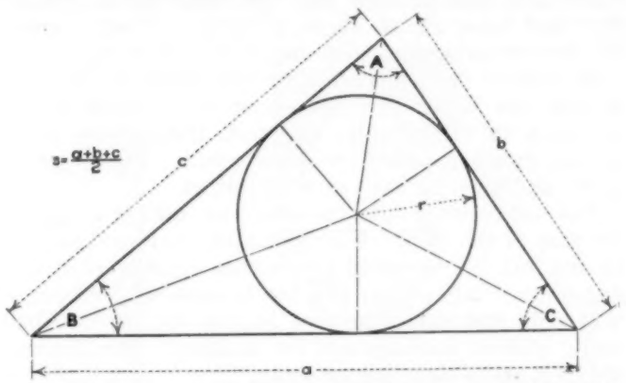
Furthermore, if the arc of the chord W were drawn from the center S instead of from O the formula would be correct and Q would equal A. Note that $P + Q = R$, but that R is the shortest distance between the two points O and D. Therefore $A + P$ is evidently greater than R, and A greater than Q.

As it is, the problem is far from complete, and gives only an approximate solution. The error in considering a four-spline shaft is much greater than when there are many splines, but it would not be safe to use the formula at all. Consequently it seems that the old way of solving for the angles w, x and y and the side of the triangle Z is still the best.

Diameter of an Inscribed Circle—Discussion

BY MOSES FINKELSTEIN

On page 527 of the *American Machinist* I noticed that Edward Heller could not find a formula for the problem which he sent in. For his benefit, I am referring him to pages 82, 86 and 87 of Wentworth's "Plane and Spherical Trigonometry," second revised edition,



THE INSCRIBED CIRCLE IS THE LARGEST BEARING THAT CAN BE TURNED ON THE TRIAGULAR BAR

where he will find the formula for a circle inscribed in any triangle. I am also calling to his attention the fact that his formula holds for a specific case only; namely, when the triangle is a right triangle. The formula which he derived is correct, and is the same as formula (3) that follows.

For the benefit of other readers I am submitting the formulas that give the radii of the largest circles that can be inscribed in triangles of different types. The proofs can be obtained by trigonometry and geometry. The meaning of the symbols is shown by the accompanying sketch.

For any triangle,

$$r = \frac{1}{s}\sqrt{s(s-a)(s-b)(s-c)} \qquad (1)$$

Or,

$$(s-a)\tan\frac{A}{2} = (s-b)\tan\frac{B}{2} = (s-c)\tan\frac{C}{2} \qquad (2)$$

For a right triangle,

$$r = \frac{a+b-c}{2} \qquad (3)$$

For an equilateral triangle,

$$r = \frac{a}{6}\sqrt{3} = 0.288675\,a, \qquad (4)$$

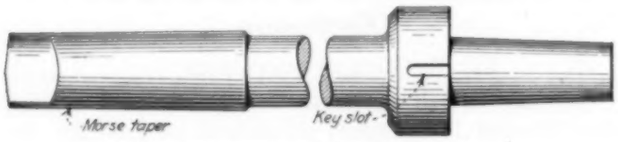
where a signifies one of the equal sides of the triangle.

Making Arbors for Shell Reamers

By Fred S. Harger

In the shop where I am employed we use a large number of shell reamers of high-speed steel for the reaming of holes in the drop-forgings and steel castings that form a large component of the coal mining equipment which constitutes our product. The work is rough and heavy, the material often hard, and the reamers are used on heavy-duty drill presses that give them no alternative but to go through, once they are started; hence care and forethought in designing as well as skilful workmanship in construction is necessary in producing the arbors.

The material of which the arbors are made is tough



ARBOR FOR SHELL REAMERS

machinery steel, and the arbors range in length from short ones that include only the combined length of shell and taper shank up to 36 inches. Each reamer has its own arbor, suited to the work it is to do.

In making the taper seats for the shells we fit them so that the latter may be wrung on by hand up to within $\frac{1}{8}$ in. of the collar, and from thence force them to the shoulder under an arbor press. The taper is slight and must be very carefully fitted.

The driver is let into the collar by milling a seat in the face of the shoulder on each side of the arbor with an end mill. A tool steel key is then fitted to each seat and pressed into place. The key is made of a thickness that will just enter the slot in the end of the shell easily without leaving room for backlash. The illustration will make clear my meaning.

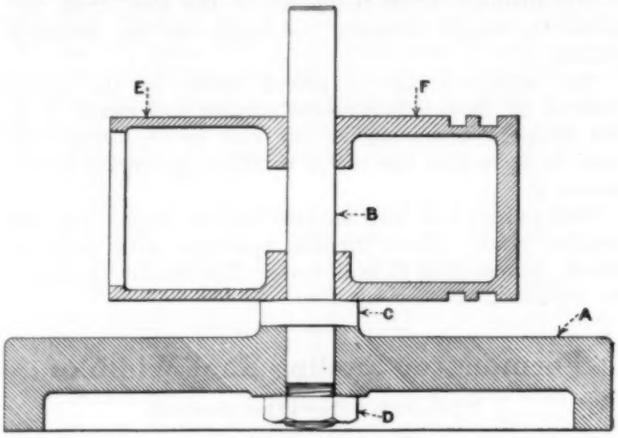
We keep a supply of the reamers in the tool crib, ready to be issued to the men upon demand. We store them upon wooden shelves with strips of wood between each reamer to prevent them from coming in contact with each other, and thus preserve the keenness of edge. Some of the reamers have been resharpened and ground off on the end so many times that they are but about half their original length, yet are still in service. As they are reduced in size by repeated grindings they are used as roughing reamers, to be followed by newer tools of correct size. In this way the effective life of the new reamers is prolonged.

Fixture for Checking Alignment of Wrist-Pin Holes in Pistons

By Douglas P. Muirhead
Glasgow, Scotland

I notice on page 137, Vol. 59, of the *American Machinist*, in one of the articles on "Tool Engineering" by Dowd and Curtis, a method for gaging the alignment of wrist-pin holes. In this method the open end of the piston is used as the locating face, and the alignment of the pin is checked in relation to this face. The method is satisfactory only if the open-end face is exactly parallel to the axis of the wrist pin, which may not always be the case.

In checking wrist-pin alignment, I have always tried to avoid using this face for location if possible, and have found the simple fixture shown in the accompanying illustration would give good results. A cast-iron block *A* carries an upright pin *B*, which is ground to the wrist-pin size and mounted at right angles to the base. This pin is a light push fit in the base and held in position by a nut *D*. The piston to be tested is



FIXTURE FOR CHECKING ALIGNMENT OF WRIST-PIN HOLES

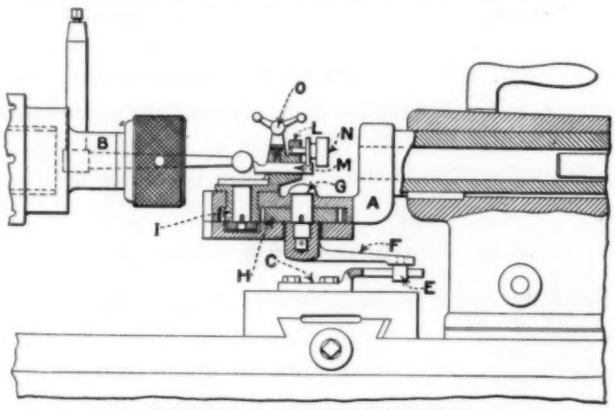
mounted on the pin and rested on the collar *C*, the fixture being placed on a surface plate. Two readings are then taken at *E* and *F* with a clock gage, or dial indicator, and the alignment checked in this way.

The diameter of the pin *B* can be made suitable for any size of wrist-pin hole. In checking pistons which have been ground taper from skirt to crown, suitable allowance must be made for the reduction in diameter. This method of checking was especially developed to check pistons that had knife-edge skirts as other methods did not give satisfaction.

Device for Spherical Turning

By Frank Ramsey

When it is necessary to turn a sphere on the end of a small shaft, a cutting tool shaped to cut the complete profile is generally used. This method has, however, two disadvantages; first, lack of precision, due to the



SPHERICAL TURNING DEVICE

difficulty in keeping the tool sharp and accurate in profile; second, small production, on account of the slow feed required to prevent chatter.

The device shown in the accompanying illustration is designed especially to overcome these difficulties. The member *A* is a pivot piece for the swiveling tool holder

L, and is fitted into the tailstock. The chuck *B* is fastened on the spindle of the lathe and carries the work.

The work having been chucked, the cutting tool, held in the position shown, is brought up to the work and fed to the required depth of cut by turning the tailstock handwheel. The slotted guide bar *C* is fastened to the cross slide of the carriage, the roller *E*, mounted at the end of the arm *F*, being located in the slot of the guide bar.

As the slide is traversed by its screw, it is evident that the arm *F* will be caused to turn about the pivot *G*, carrying with it the gear *H*. This gear meshes with the pinion I, which is fastened to the tool holder *L*, and causes it to rotate about the same center, generating a true accurate sphere on the work.

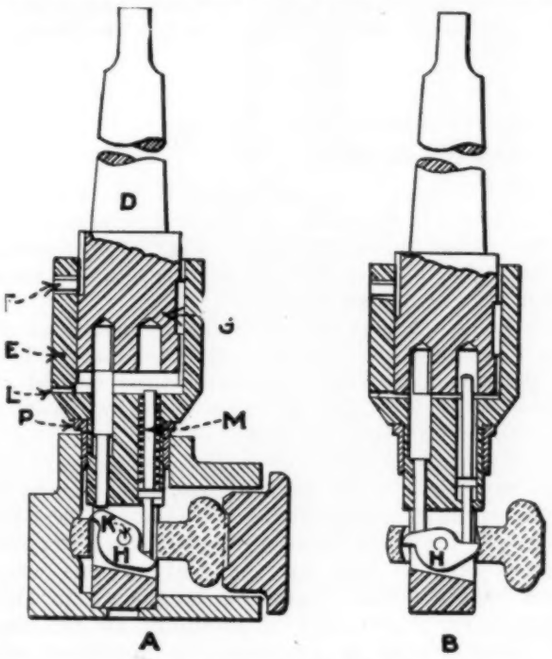
The diameter of the sphere is adjusted by means of the knurled collar screw *N*, which fits a groove in the tool *M* and moves it in or out from the center of rotation as required. The tool is clamped in position by the screw *O* when the proper setting has been made.

A Boring Bar for Spherical Boring

BY ALFRED CLEGG

This device is used to produce a spherical hole approximately 1 in. in diam., in a bronze bearing slightly less than ½ in. thick. In operation the piece to be bored is mounted in a fixture as shown at *A* in the accompanying illustration, after having been drilled to the proper size on another machine.

The shank of the tool *D* is arranged to fit the machine spindle and the pin *L* is screwed into its lower face. The section *E* carries the tool *H* pivoted on the pin *K*, and slides vertically on the shank *D*. The feather key *G* fits a keyway in the shank, and the vertical movement of the tool holder *E* on the shank is fixed by the screw *F* which strikes the lower end of its slot as *D* is raised.



SPHERICAL BORING BAR

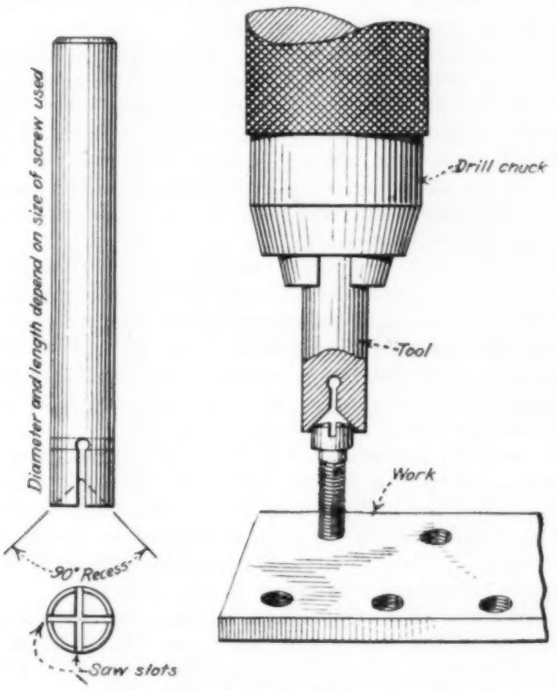
When the device is positioned in the work and fixture as shown at *A*, the rotation of *D* will cause rotation of the tool about the vertical axis and, as *D* is lowered the pin *L* will cause the tool to rotate also about its horizontal axis *K*. This action produces the spherical bore.

The spring-pressed pin *M* simply serves to hold the other end of the tool always in contact with the operating pin *L*. The bushing *P* is hardened and ground for a perfect fit in the fixture. The bore is completed when the cutting tool *H* has reached the position shown at *B* in the illustration.

Method of Inserting and Removing Machine Screws Rapidly

BY H. J. BOLL

Where castings or other parts having tapped holes in them are to be sprayed or dipped in enamel or japan it is necessary that the tapped holes be perfectly clean after this operation. In some classes of work it is not practical to tap after enameling because of the chances of marring the finish in handling. The holes may be tapped before enameling and then re-tapped to clean them after enameling, but it has been found more economical to put screws in the tapped holes and have them there during the enameling operation.



TOOL FOR RUNNING IN SMALL SCREWS

This is very speedily accomplished by the use of the tool shown herewith. The screws are started in, one turn, by hand. The tool is put in the chuck of a sensitive drill-press and the work brought up under it by hand. The friction between the tool and the screw turns the screw home instantly.

To remove the screws after enameling, simply reverse the direction of rotation of the drill press and proceed as before.

Aside from the above use, this tool may be used for permanently assembling many classes of work where screws are used.

American Machinist

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KENNETH H. CONDIT AND FRED H. COLVIN

Editors

December 20, 1923

Mr. Coolidge Breaks His Silence

LIKE A CLEAR brook flowing into a muddy swamp the words of the President's first message to Congress poured forth into the turgid atmosphere of political Washington. Mr. Coolidge's taciturnity has become something of a byword throughout the country but it is now evident that he is entirely capable of expressing himself when the time arrives.

As a courageous example of disregard of political expedience this message is almost in a class by itself. Many of the points covered could easily have been straddled or camouflaged in a glowing burst of rhetoric but Mr. Coolidge chose to vindicate the faith of his admirers by meeting the issue fairly.

The President's whole-hearted support of Secretary Mellon's tax reduction proposal has met with very general approval all over the country and particularly by the men prominent in industrial circles. His stand on the bonus has been almost equally well received although it naturally met with little favor from the members of Congress who will vote for a bonus measure no matter what happens.

We believe Mr. Coolidge's position on the immigration question is generally sound although the problem of actually selecting immigrants before they leave the old countries is exceedingly difficult to solve. No one doubts that selective immigration is the kind this nation ought to have but so far we have heard of no really practical plan for accomplishing it.

The railroad consolidation problem is almost equally difficult. There can be no doubt in anyone's mind, however, that the President is for it. He will probably have his troubles with the radical element in Congress, particularly if the LaFollette bloc gains control of the interstate commerce committee in the Senate.

It is high time to call a halt to the continuation of reductions in the Army and Navy and Mr. Coolidge's stand on national defense is therefore welcome. Certainly Europe has not recovered from the delusion that wars offer good solutions for economic problems and there are rumblings from Mexico. For the present, therefore, America can hardly afford to let her defenses rust away.

Many other subjects of vital importance to American industry are taken up in the message and disposed of with remarkable clarity of vision. We understand that Mr. Coolidge spent months in boiling down his message. Consequently we can hardly hope to do more than mention a few high spots in the short compass of an editorial.

As a model of brevity and clarity of expression we believe that this message will go down into history and rank with our great presidential documents.

Closer Limits For Trade Associations

COLLECTION of trade statistics practically is limited to those which may be requested by a governmental agency in the final consent decree in the case brought by the Department of Justice against the Tile Manufacturers' Credit Association. The proceeding was in the United States Court of the Southern District of Ohio. Before the decree was made final the law department of the National Association of Manufacturers urged the Department of Justice to permit the periodic collection of facts relating to capital employed, power used, wages, taxes paid, fuel consumed, machinery employed, in addition to production, sales shipments, stocks, prices and like pertinent trade information. It was specified that all such information was to be a record of accomplished facts.

It is known that the Department of Justice gave long and careful consideration to the proposal. The significance of the decree is increased greatly by the fact that the collection of trade statistics is not made permissible after the Department's study of the proposal.

The tile decision, if taken as a precedent will have a far-reaching effect on trade association activities. If the government is to collect fundamental statistics, it must have money and authority, meaning higher taxes and more government in business. And the information would reach the user too late to be useful.

The business man is now more than ever dependent upon statistical services. His trade association can function for him quickly and intimately, and it ought not be shackled so long as it keeps within the intent of the law.

Putting New Blood Into the Business

WHAT happens to any enterprise that is headed by men whose reputation is secure and who do not feel the need of expending much energy to keep things moving? Not much in the way of progress and sometimes a rather rapid retrogression.

With young men at the helm whose reputations are yet to be made there is quite a different story. They may make more mistakes because of their lack of experience but at least they get more done by reason of their greater ambition and activity.

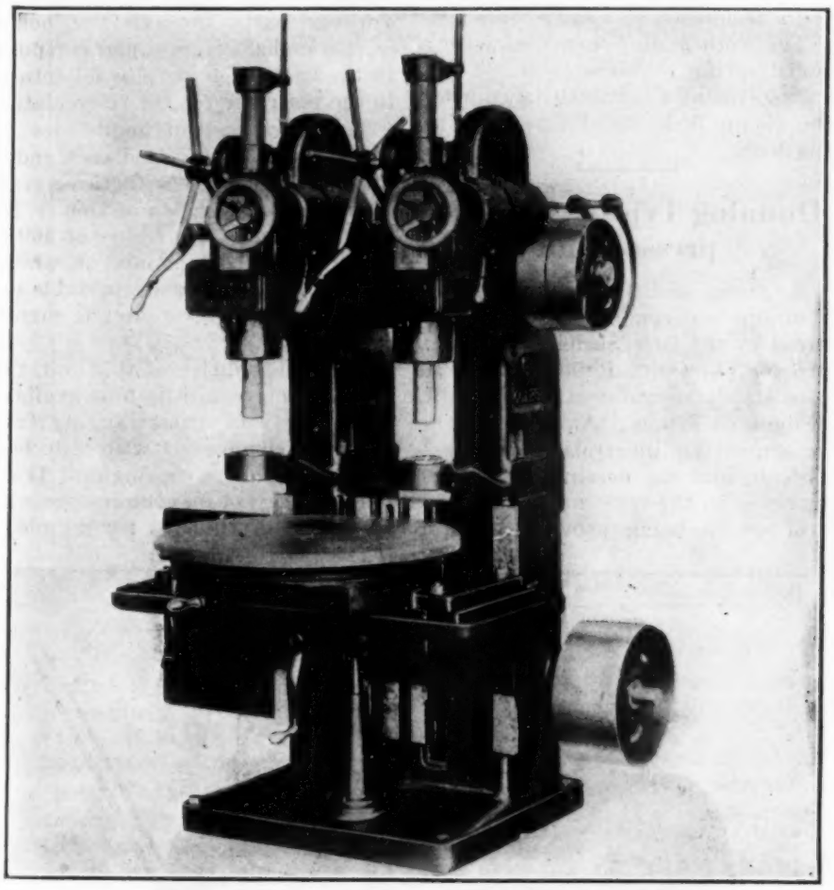
In an address to the local section delegates of the American Society of Mechanical Engineers, past president Harrington pointed to the two types of local sections where the above mentioned conditions exist. He remarked that he had observed that sections whose officers were eminent engineers, ornaments to their profession, rarely did much of anything. On the other hand, those headed by younger, less prominent men forged ahead and made themselves felt in the Society.

Young blood in any enterprise, commercial or professional, has its place. There is little question but that its impetuous course should be guided and occasionally restrained by the wisdom, or perhaps it would be better to say experience of older heads. But give it responsibility and something to do if you want results.

Shop Equipment News

Colburn Two-Spindle No. 2 Drilling Machine

The special two-spindle drilling machine shown in the accompanying illustration has recently been placed on the market by the Colburn Works of the Consolidated Machine Tool Corp. of America, Rochester, N. Y. The machine differs from the regular No. 2 double-spindle machine, manufactured by this company, only in the addition of steady supports and a speial three-station rotating table.



COLBURN TWO-SPINDLE NO. 2 DRILLING MACHINE

Two Colburn No. 2 heads are mounted on a common column which also carries a bracket type of table extending the full length of the machine. To this machine table is clamped the rotating table, the latter having three positions, one for loading, one for drilling and one for reaming. A lever for releasing the indexing latch is located at the left below the table and a lever for clamping the table in position after indexing is also provided.

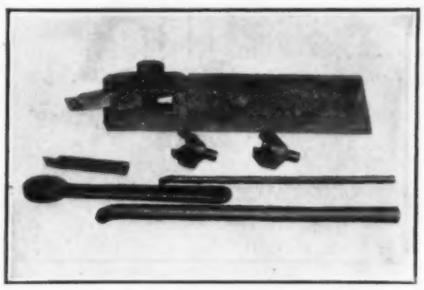
The steady supports are shown attached to the frame above the table in the accompanying illustration. An automatic trip, together with spring-type counter-weight, returns the spindle to the starting position after each operation. On work for which two stations for drilling can be used, a four-station table can be furnished and the table will then be indexed through 180 degrees to bring the work under the drills.

A 5-hp. motor for driving is mounted on a bracket at the rear of the machine and is geared to the jackshaft. The power is then transmitted to each head by a belt. The heads are entirely independent of each other and can be operated at different speeds and feeds.

The machine is designed for production work in machining duplicate parts in quantities, and is at the same time sufficiently flexible to handle a variety of work requiring a wide range of speeds and feeds.

X-L-N-T Tool Holder

A tool holder which possesses unusual adaptability and convenience is now being marketed by Marshall & Meier, 298 Mulberry St., New York, N. Y. The holder is furnished in three styles, the standard shank with capacity for $\frac{5}{8}$- and $\frac{1}{2}$-in. tool bits being shown in the accompanying illustration. A larger size to handle $\frac{7}{8}$- and $\frac{3}{4}$-in. cutters, and the illustrated size with a $\frac{3}{4}$x$\frac{3}{4}$-in. shank for speed lathes are also furnished.



X-L-N-T TOOL HOLDER

The tool bit is held in a slot in a piece which pivots in a hole in the front extension of the shank, and this arrangement allows the cutter to be swung through an arc of about 180 deg. without moving the shank in the tool post. The tool is clamped under the end of a short bar, the other end of which is seated on a shoulder of the shank. The clamp bar is tightened by means of a screw which is threaded into the shank.

The rear edge of the slotted piece is knurled and rests on a knurled section of the shank so that it will not tend to move when clamped in position. Three slotted pieces are furnished with each holder, one for the large and one for the small square tool bits, and one for two sizes of boring bars. High-speed

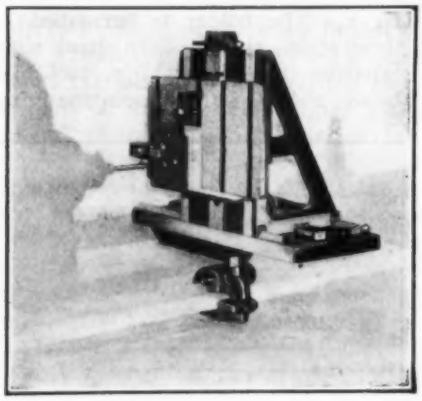
tool bits and a wrench complete the outfit.

The convenience of the holder is evident, as it performs the functions of a straight, right-, or left-hand holder, and will also handle threading and boring tools. It is quickly convertible from one function to another. All parts are made of machine steel and pack-hardened.

Craley Spacing and Boring Attachment

A lathe or milling machine attachment, designed for accurate layout and boring work, has recently been placed on the market by the C. C. Craley Manufacturing Co., Shillington, Pa. The device is shown mounted on a lathe in the accompanying illustration.

The device consists of three major parts; a base to be attached to the



CRALEY SPACING AND BORING ATTACHMENT

tool carriage; an angle plate adapted to slide crosswise of the lathe on the base; and a work-holding plate vertically adjustable on the face of the angle plate. The relative movement of these three parts allows universal adjustment of the work in relation to the boring tool, and suitable clamps are provided to hold the parts in position after the setting has been accomplished.

Accurate positioning of the work is accomplished by means of standard gage blocks in conjunction with accurate wedges which are provided on the apparatus. These wedges are two in number, one being attached to the base and the other to the angle plate. The wedges are hardened, ground and lapped and are graduated to read in thousandths of an inch.

The work plate and the angle plate carry stop pins which can be brought into contact with the wedges, or gage blocks placed in front of the wedges, in order to obtain a given setting. With the stops against the wedges and the wedges set at zero, a point on the work plate is exactly aligned with the spindle, and this point is the intersection of two lines across the faces of a guide and a pair of stop pins on the face of the work plate.

The work having been located against the pins and the guide and clamped, any point on the work may be positioned exactly in relation to the spindle by the use of gage blocks in front of the wedges together with the adjustment of the wedges themselves.

By the use of 15 standard blocks and the wedges any location may be determined from zero to the extreme limits of the attachment in both directions. A complete set of hardened and lapped blocks is furnished with the attachment.

The work plate is provided with a coiled spring on either side. These springs act as a counterbalance when the clamp is loosened for resetting the work.

Dunning Type C Air Compressor Unit

A recent addition to the line of Dunning air compressors manufactured by the Geo. Sachsenmaier Co., 926 N. Third St., Philadelphia, Pa., consists of an automatic tank unit, designated Type C. As shown in the accompanying illustration, the compressor and its driving motor are mounted on the tank, a pressure control switch being provided to stop and start the motor at given tank pressures.

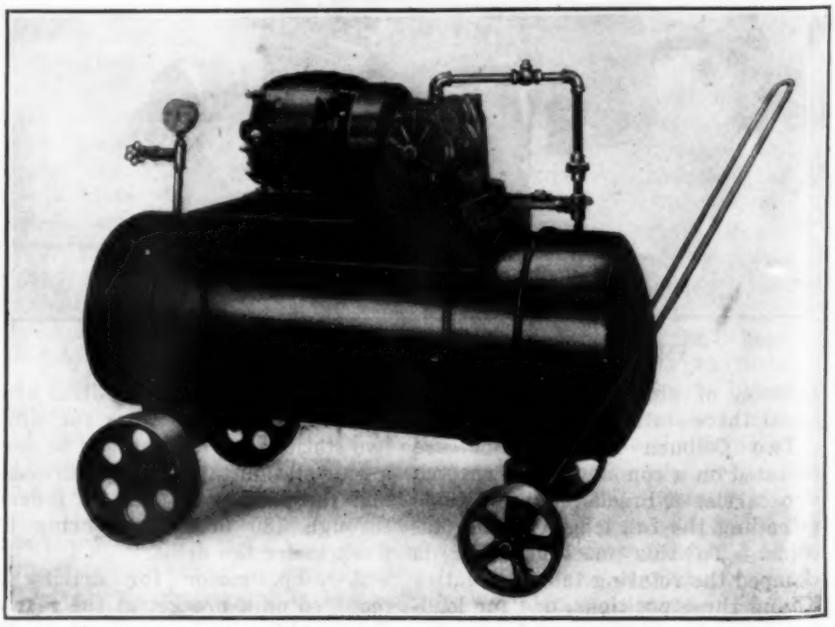
The compressor consists of a one-piece cylinder casting, the base of which forms an oil well, and in which a one-piece piston is disposed horizontally. The piston is operated from a horizontal shaft which passes through the piston at right angles to its axis and oscillates it by means of an eccentric. No connecting rods are required.

Each end of the cylinder bore is closed by a head in which an intake and an outlet valve are fitted. This construction provides a double-acting pump of exceptionally simple design and with comparatively few parts.

The pump runs at slow speed and is fitted with bronze bearings. A force-feed lubricating system is provided, the oil being distributed to the working parts through the hollow eccentric shaft from a plunger pump in the base. The surplus oil returns to the reservoir for the recirculation.

The valves are of ample size for the service required, and each end of the piston is fitted with three rings to insure good compression. The tank is tested at a pressure of 400 lb. per sq.in., and is mounted on wheels. The apparatus is easily portable and can be used wherever electric current is available.

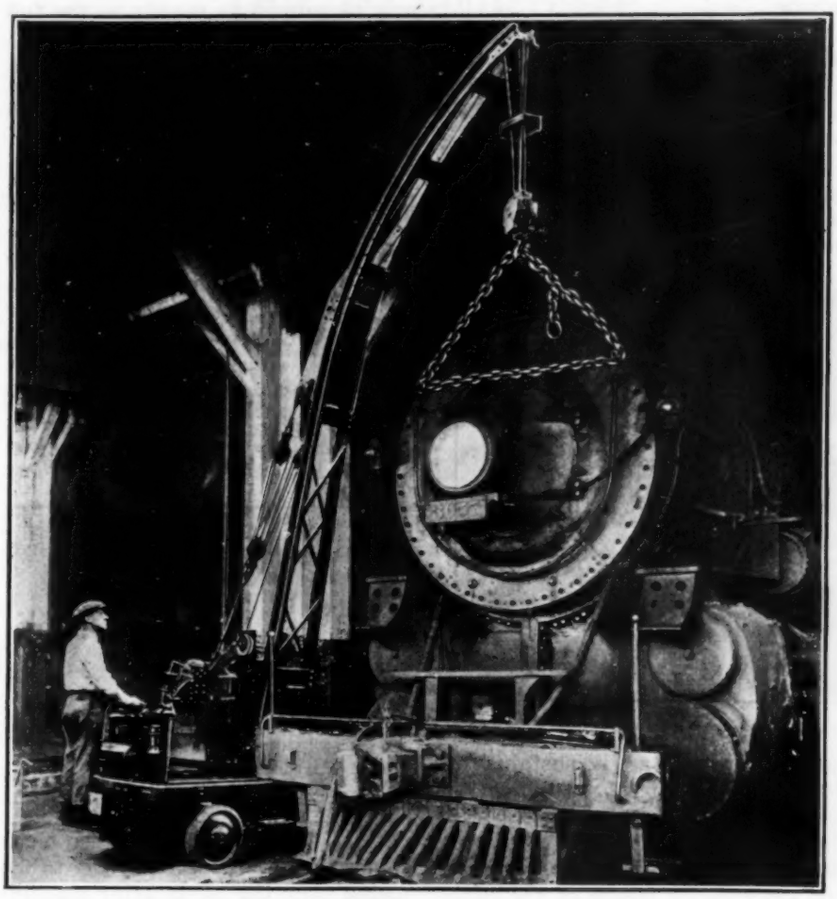
With the addition of this unit, this line of compressors is now available in a variety of sizes, ranging from the small compressor with 2-in. base and 2-in. stroke, weighing only 11 lb., to the large 4x4-in. compressors with a capacity of 30 cu.ft. per minute.



DUNNING TYPE C AIR COMPRESSOR UNIT

Baker Locomotive-Type Crane

The Baker R & L Co., Cleveland, Ohio, is now marketing a locomotive-type electric crane which has a broad field of usefulness and is especially adapted to the needs of railroad shops. It will lift and transport all sorts of heavy parts and packages; with a short boom the loading and unloading of freight cars can be accomplished; and a 19-ft. boom makes it available for work in the locomotive repair shop. The crane shown in the accompanying illustration is engaged in the latter occupation, lifting a boiler front into place.



BAKER LOCOMOTIVE-TYPE CRANE

The regular boom is 12 ft. long, and for operation inside a standard box car, an 8 ft. boom is furnished, the wheelbase being reduced to 60 in. The standard wheelbase is 70 in. and the tread is 44 in. The truck is mounted on four wheels, all of which steer, and two of which are used for driving.

All motions of the machine are electrically driven and the controls are mounted on the dash directly in front of the operator. The driving or travel motor is a Baker series-wound, 24-volt machine, running at 1,150 r.p.m., and a drum type controller provides three speeds forward and reverse. With the rated load of 3,000 lb. the travel speed is 3 mi. per hour.

The driving wheels are operated through a worm drive and a bevel pinion differential. The driving axle is of the full-floating type and is fitted with radial and thrust ball bearings. The steering knuckles and levers are fitted with renewable bushings.

Separate independent motors operate the crane slewing mechanism and the hoist. The hoist mechanism consists of two drums, both driven by the same motor through a pair of magnetic clutches. A solenoid brake prevents rotation except when power is applied and three limit switches are provided to control the operation. The drum-type controllers for these motors and a switch for the magnetic clutches are mounted on the dash.

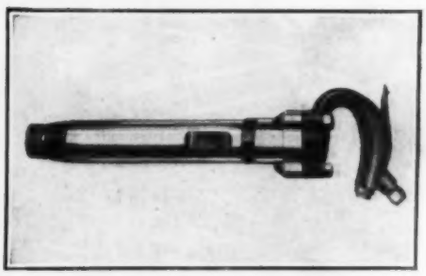
The crane will lift its rated load of 3,000 lb. at a 7-ft. radius and, with the 19-ft. boom, will give a lift of 192 in. at a 95-in. radius. The hoisting speed with the rated load is 7 ft. per min., and with no load, it is increased to 30 ft. per minute.

The driving brake is operated by a pedal and is interlocked with an automatic switch and the controller. The automatic switch is of the Baker quick-break type. The battery compartment is mounted on the crane, moving with it and counterbalancing the load on the hook. The boom is fabricated from structural steel and will be furnished of the length required. The weight of the crane without the battery is 7,000 pounds.

Ingersoll-Rand Riveting Hammer

A recent development in riveting hammers made by the Ingersoll-Rand Co., 11 Broadway, New York, N. Y., is now being marketed. The tool is illustrated herewith and has been thoroughly tested on all classes of work.

The hammer is made in three styles, A, B, and C, which are available in sizes ranging from a 5- to a 9-in. stroke. Each size can be furnished with any one of three types of barrels and with either outside or inside trigger handles. The outside trigger handle is standard and is shown in the illustration.



INGERSOLL-RAND RIVETING HAMMER

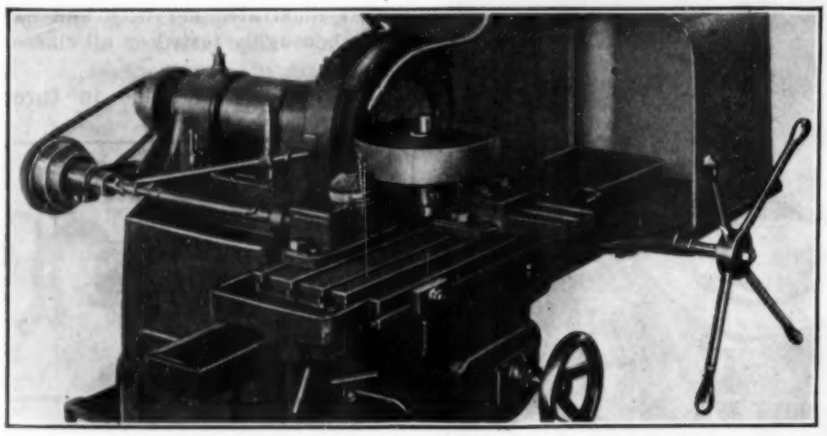
Three alloy steel bolts hold the handle to the barrel and make it possible to take the tool apart anywhere for inspection or cleaning, with a wrench only. The throttle valve is a combination of the piston and poppet types, designed to give the nicety of control and freedom from leakage required. The control is sensitive and the hammer will deliver a heavy blow or a light tap at the will of the operator.

The special alloy steel valve has a liberal bearing surface and has no holes or ports from which checks or cracks may start. It operates in a strong valve box, located in the head of the barrel and made with a solid end for ease of removal and cushioning action on the piston.

The handles are of steel, shaped to fit the hand and with a sandblast finish. The exhaust takes place through the side of the barrel, the opening being fitted with an adjustable deflector. It is stated that this hammer gives comparatively little "kick-back" in proportion to the fast, hard-hitting action and that the air consumption is small.

Graham Pulley Grinding Attachment

The Graham Mfg. Co., 71 Willard Ave., Providence, R. I., has recently placed on the market a machine for grinding the faces of pulleys. The machine is the same in its essential features as the standard Graham face-grinding machine described on page 352, Vol. 55, of the *American Machinist*, with the additional details involved in the pulley supporting and driving mechanism. By removing the latter from the table the machine is quickly convertible for straight face-grinding.



GRAHAM PULLEY GRINDING MACHINE

The pulley grinding attachment is in two parts, both of which are secured to the surface of the table by means of T-head bolts. An adjustable base holds a stationary arbor in a vertical position, upon which arbor the pulley to be ground is placed. This arbor is a free running fit for the bore of the pulley, and to mount the work for grinding requires only that it be set in place on the arbor. No driving dogs or other parts are attached, and no means of locating or supporting it in definite vertical relation to the grinding wheel are needed. Because of this condition the machine handles pulleys upon which no previous facing, or other operation than boring have been performed.

The pulley is driven by a small conical-shaped burr of hardened steel, having a serrated surface upon which the rim of the pulley rests and by which it is supported at the proper height for grinding. The driving burr receives its power through a worm and wormwheel and a universal-jointed shaft and clutch from a three-step cone pulley, which is driven by a belt from a cone on the rear end of the grinding wheel spindle.

The position of the driving burr in relation to the vertical arbor is adjustable for different diameters of pulleys by loosening two clamping bolts, sliding the burr into contact with the work and again tightening the bolts. The burr should be placed as closely as possible to the point of contact between the work and the grinding wheel, as it sustains the downward thrust of grinding. It may be located inside or outside of the pulley rim. Three work speeds, ranging from 50 to 250 ft. per min., are available by means of the cones, the speed used depending principally upon the hardness of the iron.

The driven burr may be stopped and started at any time by means of a conveniently located clutch lever but, unless the work is quite small in diameter and the speed very fast, it is neither necessary nor desirable to do so.

The vertical position of the pulley should be such that the axis of the grinding wheel is in line with the center of the pulley face. Pulleys may be ground flat, concave or with a crown, the surface contour depending on the position of the pulley in relation to the grinding wheel.

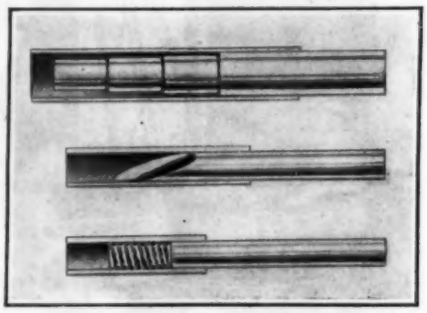
An arbor must be supplied for each size of bore, but these are simple pieces of machine steel and are changed by loosening and tightening two clamping bolts. Pulleys up to 24 in. in diam. by 6 in. face are regularly ground, and the diameter may be increased to 30 in. by removing some of the water guards.

Advantages claimed for the method are that pulleys may be cast with a small allowance for finish, and that a true and smoothly finished surface is obtainable in a fraction of the time that would be required for turning. By supplying a supporting and driving plate, segmental work may be ground as readily as the full circumference.

"Elastoid" Fiber Protectors for Metal Parts

The Elastoid Fiber Co., Waltham, Mass., is now marketing a line of protectors for metal parts, which are adapted for use in the machine shop and other metal working plants.

Many metal parts in process of manufacture present sharp corners, shoulders, edges or threads which may be easily damaged when handled in bulk. To prevent such damage these fiber protectors are furnished in a variety of sizes and shapes. The protectors are to be placed over the parts after machining and to remain with them until they are assembled or shipped.



"ELASTOID" FIBER PROTECTORS

It is stated that the cost of the protectors is so slight that they can be thrown away after use.

Melbourne to Have an Electric Show

An electrical exhibition under the auspices of the Victoria Electrical Federation will be held in Melbourne during September, 1924, Assistant Trade Commissioner, F. G. Pauly informs the Commerce Department. It is planned to cover every phase of the electrical industry, showing actual working models of the various types of apparatus from toys to machinery, transport, lighting and other industrial equipment. Both wireless telegraphy and telephony will have prominent places in the exhibition.

The duration of the affair will be for four weeks, taking in the period during which the Royal Agricultural Show is held.

News Section

Immigration Problem Is Subject of Two Day Conference

In an attempt to develop constructive suggestions looking to the solution of our immigration problem, the National Industrial Conference Board called a meeting at the Hotel Astor, New York City, Dec. 13 and 14. Delegates from a number of social and industrial organizations attended and expressed their views. No action of any kind was taken, but several worthwhile recommendations were made by speakers.

Among them was the proposal to require the steamship company to provide facilities for medical examination, no passport to be visèd unless accompanied by a medical certificate. This suggestion gets around the difficulty of providing for selection of immigrants by American officials abroad which is rightly considered by other countries as an infraction of their sovereignity. Another suggestion was that serially numbered certificates equal in number to the annual immigration quota be issued to prevent the deportation now enforced by exceeding quota restrictions.

Canadian System Favored

The general feeling expressed was that the Canadian system of selecting immigrants, based on the needs of the country as a whole, had many advantages. No particular group should be able to secure immigrants which might fit their requirements, but which could not be absorbed and become of real value and benefit to the whole country. The Canadian system checks immigration at the point of embarkation, where the immigrant receives his passport or other certificate.

The subject of regulation was discussed from many angles. Nearly everyone seemed to believe that the time had arrived when it had become necessary. It was advocated that the cost be made as low as possible and that red tape and chances for annoyance be reduced to a minimum.

One of the greatest evils is believed to be the many ways in which immigrants are fleeced, beginning almost as soon as they land. The exasperating feature of this is that nearly all of it is done by shrewd members of their own nationality, who easily secure the confidence of the victim. Max Kohler of the Baron de Hirsh Fund feared that compulsory registration would open the way to numerous abuses of the immigrants by inspectors. This view was not shared generally and was vigorously opposed by E. D. Henning, Assistant Secretary of Labor.

The attitude of labor was outlined by Hugh Frayne of the American Federation, who defended the contract labor laws and the present restrictions. He advocated, however, that each U. S. consulate should have on its staff members representing the manufacturers, agriculture and labor and that these men handle all calls for labor from different groups in the United States.

It was pointed out by several speakers that most of the criticisms of restrictions and registration came from those who, unconsciously perhaps, were more concerned in relieving their fellow countrymen than in securing the people best suited to the needs of this country.

Fear Sperry Was Drowned in Channel

All indications would point to the probable death of Lawrence B. Sperry, the American flyer, whose airplane was picked up in the English Channel recently. Conclusions are that Sperry had some trouble with his plane and landed safely enough in the Channel but made the mistake of trying to swim a distance of more than three miles in the icy waters.

Lawrence D. Sperry was one of America's best known flyers. He was a rare combination of spectacular flyer and competent pilot and was considered by many to be one of the ablest flyers that the world has yet known. He was the recipient of the French prize some years ago for his exceptional flying at which time he demonstrated his father's gyroscopic stabilizer to the delight of the French judges.

Recently he had been building the Sperry Messengers, a new type airplane for use in the United States army and Navy.

Unemployment Causes Waste

Unemployment during the periodic troughs in the business cycle is responsible for the greatest single waste. Troughs in the business cycle can be done away with if booms are eliminated. Accurate information as to stocks, consumption and distribution of commodities, made available at frequent intervals, will do much toward eliminating booms. These opinions were expressed by Commerce Secretary Hoover, in the course of remarks Dec. 5 at the annual dinner of the Washington Society of Engineers.

In the course of his remarks, that dealt largely with standardization and simplified practice, Secretary Hoover stated that one of the leading economic boards in the country had reached the conclusion that the exhaustive statistical service, represented by the business survey of the Bureau of the Census, and other figures compiled by the Department, had contributed more than any other single factor to the stabilization that has characterized business during the last twelve months. These figures permit the individual business man to interpret his own situation in relation to the country as a whole. Not long ago, Mr. Hoover pointed out, three great American industries practically went through bankruptcy because they had overstocked raw materials.

Ford Cylinders from Furnace "Dust"

Henry Ford has begun the manufacture of cylinder castings from "dust." On the 50,000-ton mountain of "dust" whose peak at the River Rouge plant has been rising higher and higher for three years, the pile has been fed by the Ford blast furnace. From this "dust" he proposes to build 600,000 cylinder castings. It will take a year and a half to use up the mountain.

The Ford company has announced that it has begun the reclamation. It isn't "dust" in the ordinarily accepted term. It is blast furnace dust, a fine sand-like substance which is blown from the furnace in the blast and is utterly worthless in that state. It is valuable, however, because 50 per cent of it is iron ore. The other 50 per cent is coke dust.

Cylinder Production

It is estimated that of the 50,000 tons in the dust mountain at River Rouge, 25,000 tons are iron ore in dust form. The reclamation of the 25,000 tons of iron ore means sufficient ore for more than 600,000 cylinder castings weighing 82 lb. each.

A new sintering plant has been built for the work. It stands close to the two big blast furnaces and joins the giant ore bins from which the furnaces are fed. The furnace dust, caught up in suction conveyors, is carried directly to the sintering plant and there is mixed with cast iron borings gathered from the various Ford manufacturing units.

A gas flame of intense heat is passed over the dust, and the action of the coke under this heat and the suction draft, fuses the mixture into chunks of size and weight for use in the furnace.

Business Editors Meet with Hoover

The members of the National Conference of Business Paper Editors attended a meeting at Washington, D. C., recently at which Secretary of Commerce Herbert Hoover discussed national problems as they apply to the business situation of the country, and plans for the coming six months were discussed. A luncheon was enjoyed by the members attending. Approximately thirty-five business publications were represented.

Improvement in Buffalo Business After Many Quiet Months

Most Buffalo machine tool dealers report conditions for this season of the year highly satisfactory. An occasional pessimistic note is sounded but, on the whole, inquiries are good and indicate now that there will be a good buying movement in this district for at least the first quarter of 1924 and that it will probably extend into part of the second quarter of the year. Many inquiries are reported for industrial equipment to be delivered after the first of January or even later in the Winter and Spring. There is an exceptional demand which has been developing during the last ten days, and is likely to increase, for road building machinery and tools that are commonly used in construction. Part of this is said to be due to the fact that the New York State Highways Department is letting its contracts for state road construction in the Autumn now rather than later. All of this equipment is, of course, being quoted for Spring delivery.

Straggling orders in general lines are being placed at the present time, although no orders of mention have been reported in this district in the last ten days. The fact that the few sales are of a general nature and that the inquiries are also general, and from many different points, is considered by some an omen of good, stable business conditions and an excellent condition for the machine tool business.

Inquiries have been common in pipe and pipe fittings as well as allied lines. The electrical line is very quiet, however, the demand for central station equipment being practically at a standstill. There is a demand for industrial electrical equipment of a wide variety.

One of the interesting developments of the week was the report that the Pierce-Arrow Motor Car Co., after a careful study, is about to make delivery of a new chassis designed for bus transportation. The delivery of the first three will be made to a Virginia concern about Jan. 1. The body building is not done here. The motor is six cylinder and is said to develop 125 hp. It is designed to transport a maximum of forty persons at a maximum speed of sixty miles per hour without difficulty.

Chicago Market Gets Many Inquiries

Sales of machine tools in the Chicago district were light this week. With few exceptions industrial concerns are doing little buying of used or new machinery. Inquiries are far in excess of sales and dealers look for a good volume of business in January.

The National Metal Trades Association's free employment office has more applicants than at any period since March, 1922. Large concerns such as the Goodman Manufacturing Co., the Union Special Machine Co., and the Kellog Switchboard & Supply Co. continue operations with scarcely less than their normal working force, but the small concerns in the Chicago district are operating with a greatly reduced working force.

The Cleveland, Cincinnati, Chicago & St. Louis R.R. has placed an order with the Whiting Corp. for a 120-ton, double trolley electric traveling crane. The Missouri Pacific R.R. is reported to have purchased a 400-ton wheel press and a 48-in. car wheel borer. The Chicago, Indianapolis & Louisville Ry. has issued an inquiry for a 48-in. x 10-ft. tool room lathe. The Richmond, Fredericksburg & Potomac R.R. has purchased a 25-ton, 8-wheel standard gauge, steam operated crane from the Orton & Steinbrenner Co. The New York Central R.R. is reported to be now inquiring for about 100 tools. Recent sales to industrials include four planers, one 52-in. x 48-in. x 12-ft., one 36-in. x 42-in. x 10-ft., and two capable of handling material 12-ft. wide, 12-ft. high and 20-ft. long. Also two heavy duty turret lathes and a 12-spindle cluster drill. A Chicago industrial is making inquiry for machines of various descriptions, amounting to about $25,000.

There were several important developments during the last week in the steel industry. One was the abolishing of "Pittsburg Plus" by the La Salle Steel Co., and the other was the reduction in the price of cold drawn screw steel and shafting by the Fitzsimmons Steel & Wire Co. and the Bliss & McLaughlin, Inc.

Western Canada Has Good Gains

Machine shops and small foundries throughout eastern Canada report a slowing up of business, but conditions are just the opposite in Ontario and the Western provinces where the great activity prevailing in the pulp and paper industry is creating an increasing demand for tools and other supplies. Those plants that depend largely on railroad work are looking anxiously forward now for some announcement as to the 1924 construction plans. It is understood the programs of both the Canadian National Railway and the Canadian Pacific Railway have been prepared, but there is no indication as to when buying will commence. It is quite possible that the contemplated extensions of the Canadian National Railways, involving an expenditure of approximately $14,000,000, which were held up by Parliament last session, will be approved at the coming session. This would establish quite an important market for supplies.

Indicating generally enlarged business in Canada during the past year, construction contracts awarded for the eleven months ended November show an increase of nearly thirteen per cent. The total for the period was 293 million dollars, the largest increase being in new construction of public utilities. Total awards during November are placed at $15,632,000, as compared with $21,453,000 in November, 1922. The outlook for the coming year is for a slightly increased volume of general building.

A substantial increase in the net operating revenue of the Canadian National Railways for the first nine months of the year is shown in a report just to hand. The earnings were $6,857,815 compared with $527,313 for the similar period of 1922. The volume of freight moved in Canada in October was the largest in any month during the past two years. This indicated the full swing of the grain movement, but also must be regarded as showing very substantial improvement in business activity.

Inventory Time in Milwaukee

Business in machine tools has assumed the customary aspect of the period immediately preceding the holidays and the close of the year. Manufacturers as well as dealers at present are engaged in gathering up the loose ends and preparing for the inventory and holiday vacation periods. Buyers of metalworking equipment apparently have satisfied their requirements for the remainder of the year and sales have become of a distinctly scattering nature, with only the most urgent and emergency needs being filled.

Local machine tool makers are approaching the end of the year with a smaller volume of unfilled orders than at this time last year. Sales for the year are expected to compare favorably in volume with the preceding year, however. While a year ago a moderately heavy buying movement was setting in late in the Spring, conditions were reversed this year and there has been a gradual slackening of demend since May and June, although several months just past have measured up well with the corresponding months in 1922.

On the basis of increased inquiry in November, which continued to gain in December, builders and dealers in the local machine tool market express confidence that buying activity in 1924 undoubtedly will represent a substantial advance over the year now ending. There seems to be no question in their minds that the caution which became pronounced at mid-year and was then sharply reflected into sales, has been gradually dissolving and the metalworking trade in general looks forward to a new year with substantial hopes of genuine improvement.

Auto Production Steady

Concern over the future of the automobile business, which furnished the most important demands upon manufacturers of metalworking machinery during the past twelve to eighteen months is passing as the result of the progress made by this industry in the face of seasonal influences that ordinarily have made the last three months of each year the lowest in point of sales. While the expectancy is for a substantial absorption of new tools by the passenger car trade, it is believed by many that the coming year will witness a healthy advance by the manufacturers of motor trucks and motor buses which should have a beneficial influence on tool business. While facilities of these departments of the automobile business have not been overtaxed all through 1923, a very real need for greater production is seen in the immediate foreground because of the stronger degree of security in the

future of motor transport of freight and passengers that has appeared in recent months.

The railroad situation and its bearing upon the demand for metalworking machinery has brightened locally. The expectancy of a strong demand has been sustained despite the disappointing manner in which it has developed for the past year, and it is believed that unless the Congress pounces upon the railroads in an unforeseen manner, the financial ability of the carriers to purchase tools and materials will be enhanced to the obvious advantage of virtually every department of the iron, steel and machinery trades.

Quiet Business Is Detroit's Lot

With the approach of the holidays and the general let-up in Detroit's automotive industry for the latter part of December, the machine tool industry is showing a slight decline. This has not reached the proportions of previous years, however, and leaders in the industry are one in their belief that the lull which is approaching is but the forerunner of an active market after the first of the year.

Four new cars, products of smart craftsmanship, have just made their bow to the automobile public. Presaging some of the refinements that will be forthcoming next year, they indicate the strides accomplished in 1923 and herald advances that may be expected generally in 1924.

Balloon tires, four-wheel brakes, automatic spark control, fewer doors, wider doors, and most interesting of all—better prices, are represented in the quartette of new models which has engaged the public interest for the past few days. Attention has been centered on closed cars, with the result that some striking "all-season" types are available.

Expansion Expected

Following closely on the heels of an increase in capital stock of the Paige-Detroit Motor Car Co. from $4,000,000 to $8,000,000, the board of directors has declared a 50 per cent stock dividend. "Expansion policies, combined with the tremendous success of the Jewett during the year 1923 has made possible this liberal dividend payment." Harry M. Jewett, president, declared. "This increased business has also made possible the completion of a new $1,500,000 plant for the exclusive production of the Jewett. This plant will have a capacity of 500 Jewetts daily. Present plants will be turned over to Paige production. These will have a capacity of 150 cars a day."

The same conditions as are found in the Paige plants prevail in every other large automobile factory in this section. With the 4,000,000 mark in car production for 1923 in sight and prospects bright for next year, an absence of fear features industrial activity.

Body companies of the city, with their employees numbering nearly 40,000, report an ever-increasing demand for closed bodies. The open cars are now becoming largely special jobs, it is said, and considerable rearranging has been necessitated in the body plants because of the extraordinary preponderance of closed types called for.

Building figures for the first eleven months are nearly $120,000,000, and the 1923 total will exceed those of 1922, the highest previous year, by more than $30,000,000.

Employment in the city continues to hold its own, a remarkable occurrence for this time of the year.

New York Preparing for New Year

Sales of single tools and a few orders from the railroads that are closing on lists of long standing are the only outstanding features in an otherwise featureless machine tool market in the New York City district. December, never an active month, is living up to tradition, and dealers report that while it is on a par and in some cases better than last December, the month will be below both October and November in the total number of sales.

But next year—that, according to dealers, is another story. Preparations for unusual activity during the first quarter are being made and sales campaigns are being whipped into shape for the expected business during February and March. Inquiries have been very plentiful and advices from most industrials state that after inventory and after appropriations for the year have been made buying will commence.

One dealer expressed the belief that the first two quarters of 1924 would be equally as good as the first two quarters of this year and that the politicians would see to it that the last two quarters would be periods of prosperity as well.

Buying from the automobile shops is expected over the entire year, railroad buying is practically assured, Japan will probably be in the market by the middle of February, and the expansions of general industrials at this time presages equipment buying in March and April.

Dealers in used machinery are of the opinion that business for them, too, will be better and more even during the coming year than in 1923. Business has not been bad with them this year, but it has been unusually spotty and erratic.

Exporting is better than has been the rule for this season of the year and promises to keep above the standards set in other years. Severe weather will mean poor shipping, but it is to be expected and, therefore, is provided for by the exporters.

News of Washington Activities

By Paul Wooton

The budget which just has been submitted to Congress provides $130,000 to enable the Bureau of Standards to co-operate with Government departments, engineers and manufacturers in the establishment of standards, methods of testing and inspection of instruments, equipment, tools, and electrical and mechanical devices used in the industries and by the Government. This includes the practical specification for quality and performance of such devices and the formulation of methods of inspection, laboratory and service tests. This will permit of some expansion of this work. The amount appropriated for the current fiscal year was $100,000.

For technical investigations in co-operation with industries, upon fundamental problems involved in industrial development, with a view to assisting in the permanent establishment of new American industries, the budget carries $180,000. This is $30,000 more than was made available for use during the current fiscal year.

The Brown Plan

Prospects favor the success of the Brown plan for the reorganization of the administrative departments of the Federal Government insofar as concerns the setting up of a Division of Public Works in the Interior Department, and as it pertains to the Department of Commerce.

The main objection to the Division of Public Works comes from the Corps of Engineers of the Army. The plan will include, however, provisions to insure the assignment of engineer officers to river and harbor projects and other public construction.

The major changes in the Department of Commerce have been agreed upon unanimously. The President has authority in law to move the technical bureaus in that Department. The Attorney General now is considering if existing law does not authorize the transfer of all technical bureaus affected by the Brown plan by executive order. It is admitted, however, that legislation will be required to bring about the creation of the public works division of the Interior Department.

So far as the remainder of the proposed reorganization is concerned, there seems little chance of putting it through. Once that heads of departments become wedded to the bureaus under their charge, it is very difficult to reach agreements as to transfers. The remainder of the reorganization plan, it is believed, must await some new administration. If it can be accomplished within the first three months of an administration's course, before it has settled in its tracks, reorganization can proceed smoothly.

Coolidge on Coal

Insofar as it deals with coal, the President's message is ambiguous. It gives the impression that he is not in favor of regulation except during extreme emergency, but there appears to be great difference of opinion as to the significance of what he said. It indicates that he is doubtful whether the Federal Government has any power to fix prices, wages or profits, or take similar action in peace times. He does make the clear-cut statement that he does not believe in Government ownership. This statement could have been little more than a gesture since hardly anyone believes in it and certainly there had been no doubt as to Mr. Coolidge's position concerning the matter.

Programs of Auto Production

With an annual automobile show scheduled for January, leading motor car companies are working out their production schedules for the new year. Some have already fixed their programs for 1924. For companies which have announced their plans, an increase in output is predicted, compared with that reported for 1923. In some instances the increase will be accompanied by a readjustment of the financial structures of the companies.

The Jordon Motor Car Co. of Cleveland, according to reports in the New York financial district, is expected shortly to call a meeting of stockholders to approve an increase in the company's capitalization, and to authorize retirement of the outstanding preferred stock.

The Chandler Motor Car Co. announces that its production program for 1924 calls for 22,500 to 25,000 cars, of which 10,000 are expected to be turned out during the first quarter. The higher production for the first quarter, according to officials, is for the purpose of meeting the heavy demand expected in the Spring. This year, it is pointed out, the company produced 16,600 cars in the eleven months and the total for the twelve months is expected to aggregate 17,500 cars.

The production program of the Hupp Motor Car Co. calls for an output of 50,000 cars next year, of which 75 per cent are expected to be closed cars. Officials declare they were forced to turn down orders for 7,500 cars last Spring because of inability to make deliveries.

The Packard Motor Car Co. announces that its plants are operating on a schedule which calls for a monthly production of 600 single eights and 1,300 sixes. This is capacity operation for the company's factories in Detroit. A greater percentage of closed bodies is being produced than at any time in the company's annals.

Patent Law Amendment Introduced

The following bill was recently introduced in the House of Representatives by Congressman Lampert:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that whenever a mistake in a patent or trade-mark registration, incurred through the fault of the Patent Office, is clearly disclosed by the records or files of the office, a certificate, stating the fact and nature of such mistake, signed by the Commissioner of Patents and sealed with the seal of the Patent Office, may be issued, without charge, and recorded in the records of patents or trade-marks, and a printed copy thereof attached to each printed copy of the patent or trade-mark registration, and such certificate shall thereafter be considered as part of the original, and every patent or trade-mark registration, together with such certificate, shall have the same effect and operation in law on the trial of all actions for cause thereafter arising as if the same had been originally issued in such corrected form. All such certificates heretofore issued in accordance with the rules of the Patent Office and the patent or trade-mark registrations to which they are attached shall have the same force and effect as if such certificates had been specifically authorized by statute.

LAWSUIT ELIMINATOR

"Sec. 2. That section 892 of the Revised Statutes be, and the same is hereby, amended to read as follows:

" 'Sec. 892. Written or printed copies of any records, books, papers, or drawings to the Patent Office, of letters patent, of prints, authenticated by the seal of the Patent Office and certified by the commissioner thereof, or in his name attested by a chief of division duly designated by the commissioner, shall be evidence; and any person making application therefor and paying the fee required by law shall have certified copies thereof.' "

"Sec. 3. That section 11 of the Trade-Mark Act of Feb. 20, 1905 (Thirty-third Statutes at Large, page 724), be, and the same is, hereby amended to read as follows:

" 'Sec. 11. That certificates of registration of trade-marks shall be issued in the name of the United States of America, under the seal of the Patent Office, and shall either be signed by the Commissioner of Patents or have his name printed thereon and attested by an Assistant Commissioner of Patents or by one of the law examiners duly designated by the Commissioner of Patents, and a record thereof, together with printed copies of the drawing and statement of the applicant, shall be kept in books for the purpose. The certificate shall state the date on which the application for registration was received in the Patent Office. Certificates of registration of the trade-marks may be issued to the assignee of the applicant, but the assignment must first be entered of record in the Patent Office.' "

Farrell Urges Export Development

America's opportunity in the industrial world now lies in hitherto undeveloped markets, in the opinion of industrial experts who addressed the third foreign trade conference of the Cleveland Chamber of Commerce recently.

James A. Farrell, president of the United States Steel Corp. and of the National Foreign Trade Council, was the principal speaker. Japan was the chief topic discussed.

Flying Boat Makes New Record

A new record for weight-carrying in flying boats, equipped with one Liberty motor, was made off Raritan Bay, in the new Aeromarine all-metal-hull flying boat, according to an announcement by Paul G. Zimmermann, chief engineer of the Aeroplane Plane & Motor Co.

The flying boat took off after a 65-second run, in a 15-mile wind, carrying 3,445 lb. useful load. This represents 47.2 per cent of the gross weight of the machine.

Hoover Reports on 1923 Activities

Legislation for the revision of the navigation laws, for control of traffic in the air and for stabilization of radio service were among the recommendations made by Secretary Hoover in the annual report of the Commerce Department. The rapid growth of aircraft and radio transmission alike, he said, had created a need for administration development, while the navigation laws, long under scrutiny, required adjustment to the increased commercial expansion.

Within the department itself Mr. Hoover recommended that Congress follow the general reorganization plan prepared under the Harding Administration and make three administrative groupings to deal, respectively, with industry, trade and navigation. He likewise urged Congressional affirmation for the acts by which President Harding created Alaskan fisheries reserves and suggested relief from Federal taxation for Americans resident abroad and engaged in furthering American commerce.

DEPARTMENT'S SPECIAL WORK

Much of the report dealt with the special enterprise, in which the Commerce Department has engaged during the year, designed to standardize commodity and material specifications, to collect facts about world agricultural production and to determine the character of organizations abroad by which it has been charged that American consumers have been threatened with unduly high prices.

"Through the huge export balances of the last few years we have shifted from a debtor to a creditor nation," said Mr. Hoover, "and the theory is now more or less generally accepted that our hitherto normal excess of exports over imports must ultimately shift to an excess of imports, as we have large balances to receive in payment of interest. The gradual reduction of the monthly export excess in 1922, culminating in the Spring of 1923 in four consecutive months in which imports were larger than exports, does not necessarily mean that this time has arrived."

In reviewing business conditions, Mr. Hoover declared activity had increased from month to month during the fiscal year.

New Ford Power Plant Is Nearing Completion

Construction of the first of eight new 62,500-hp. turbo-generators to be installed in the Ford Motor Co. power house at River Rouge, Mich., is 85 per cent completed. The test run is scheduled for January. The second unit is 15 per cent under way.

With all units now planned in place, the Rouge power plant will be capable of producing one-half million hp., taking its place among the greatesst plants of its kind in the world. This enormous power production, according to present plans, will be used entirely for Ford industries and the electrification of the Detroit, Toledo and Ironton R.R. that is owned by Mr. Ford.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By THEODORE H. PRICE
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SOME students of hygiene maintain that an equable climate is depressing to those who live in it. They assert that frequent changes in temperature and humidity stimulate the human organism and that without them men become inert. This is another way of saying that "variety is the spice of life," physically as well as mentally.

Perhaps the same thing is true of business life, for the story of last week's markets is one of normal stability and activity that fails to inspire enthusiasm because it has become monotonous. Cotton is about the only commodity whose price has changed much, but the cotton market would not be normal if it was stable and people are no longer excited by its vagaries. The Government crop estimate putting the crop at 10,081,000 bales was published on Wednesday. It does not prove anything, but it has reawakened the fear of an acute shortage at the end of the season and has enabled the bulls to reform their ranks and rekindle the ardor of their followers.

But the lack of excitement in the dry goods market is noteworthy and cotton goods are not yet selling at the parity of 35 cents for the raw material. The known facts indicate higher prices, but it remains to be seen whether their influence is spent because they are known.

The stock market is in much the same condition. It is firm but it has ceased to advance aggressively. Here again the bullish significance of the known facts is admitted. Railroad earnings are good and many industrial corporations are declaring increased dividends in order to distribute their increased earnings. The only exceptions are the Chicago & Northwestern R.R., which reduced its semi-annual dividend and the "Omaha," which passed its semi-annual dividend altogether. These are both called Vanderbilt properties and the action of their directors caused no little surprise. It is explicable only upon the theory that the payments withheld were required for improvements and maintenance, as the gross revenue of both roads exceeds last year's. It is, however, undeniable that the market for all railway securities is held in check by the fear of adverse legislation by Congress when the railroad bill comes up for consideration.

The bond market is firm and Government securities in particular have worked upward on the buying of "Liberties" attributed to the Federal Reserve banks, who are supposed to be investing their unemployed funds in the open market.

The staples other than cotton have changed but little in price. Sugar is slightly higher upon the downward revision of the large crop estimates previously current. Iron and steel are quieter as is natural in view of the large business booked a month ago. The non-ferrous metals show but little change. The jobbing trade is quiet as usual at the Christmas season, but the department stores report a holiday business that is already well ahead of last year.

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The November statement of our foreign trade confirms this view. Merchandise valued at 404 millions was exported, while our imports were worth but 292 millions. The balance of 112 millions in our favor was in a measure offset by November gold imports worth $39,000,000. The probabilities are that the December imports of gold will be even larger and it is quite possible that our net imports of gold during the calendar year will reach $300,000,000, to which must be added the domestic production of gold amounting to approximately $50,000,000.

The effect of this gold upon the commodity markets and business in general continues to be the unknown quantity in the price equation.

There seems to be but little likelihood that we will export any substantial portion of the gold we have accumulated in the near future and the Federal Reserve banks are trying to camouflage it by putting gold certificates in circulation. By this method they may for a time succeed in stifling its inflationary influence, but it is to be doubted whether they can do this much longer and everyone who has even a rudimentary knowledge of economics must admit that when the point of "gold saturation" is reached prices will rise by leaps and bounds. A sub-conscious appreciation of this probability is probably responsible for the steadiness of the markets, while doubt as to its imminence is the only reason for their hesitancy.

The weekly statement of the Federal Reserve System should therefore be closely watched. For last week it shows a decrease of $2,500,000 in the gold held and a reduction of 1.1 per cent in the reserve ratio, which now stands at 75.3. These changes are both due to the holiday demand for currency which seems to have been met chiefly by paying out gold that is likely to come back during January, when it may be practicable to get a better idea of a situation that is without precedent.

The problem is still further complicated by conditions abroad. It is said that much of the floating capital of Europe that is usually kept in London is being transferred to New York in the fear that the success of the labor party in England may give it control of the British government and open the way to an imposition of the "capital tax levy." These transfers will compel London to send more gold here and still further postpone the resumption of specie payment in Great Britain.

As to Germany and France, there is little reason to hope that they can even stabilize their present currency and the exchange value of the franc is slowly declining as the financial condition of the French government becomes understood.

The revolution in Mexico is another discouraging development. That it has come so soon after our recognition of the Obregon government is perhaps fortunate for us as there has not been time enough to put much American capital in Mexico, but it is a great disappointment to those who had hoped that an era of tranquility and prosperity was at last assured for the Mexican people.

The immediate effect in this country has been a decline in all Mexican securities, but its consequences otherwise have not been important and they have caused hardly more than a ripple in the tranquil sea of American prosperity and opulence.

Steel Ingot Production Shows Increase

Production of steel ingots in November aggregated 3,113,804 tons, according to the returns of companies reporting to the American Iron and Steel Institute and producing 95 per cent of the country's output. The companies actually reporting produced 2,969,012 tons. October production totaled 3,547,966 tons, of which the companies reporting produced 3,382,986 tons. In November, 1922, the respective totals were 3,430,309 and 2,889,297 tons.

Germany's Continual Wage Arguments

"Pre-war wages for pre-war efficiency" is the battle cry of the employer—What labor wants and what it will probably get—Will prices take a corresponding drop?

BY OUR BERLIN CORRESPONDENT

WHILE the chaos into which the collapse of the passive resistance has plunged Germany is still deepening, indications are not absent that a new process of crystallization has already commenced. To speak of chaos is hardly an exaggeration. The Ruhr problem in a most critical stage, business at a low-water mark and the void created by the shipwrecked currency, are factors that can hardly be surpassed. They have taken from the country's economic leaders at last some firm resolutions and are commencing to create in the whole population an intense longing for healthier conditions even at the sacrifice of time-honored tradtions.

The ground is being broken for reconstruction on a new basis. The German people are beginning to realize the economic disaster that would result from the detachment of the Ruhr and Rhineland. They seem to reconcile themselves to this possibility as something inevitable. Rhine and Ruhr are now being considered an open wound, which an invisible agency will not let heal. If the rest of Germany is to recover, amputation is regarded in many minds as the last resort.

The belief has established itself as an indisputable truth that, without the good-will of the occupying powers, business on the Rhine and Ruhr cannot revive, no matter what exertion and sacrifices are made, and that the good-will cannot be obtained as long as the two provinces remain members of the German State. This line of thought appears now to shape the course of events. It coincides also with the line of least resistance, which commends itself to a country in such a weak state as Germany. The resistance against the separatist movement is wavering visibly and it would not be surprising to see the alienation of the two provinces. Curiously enough the theory is gaining ground that each of the two parts would separately recover more quickly than in unison.

Solving the Labor Problem

The attitude toward the labor problem is becoming bolder every day. Up to a short time ago, the extermination of the revolutionary labor achievements could scarcely be discussed in public. All that public discussion would tolerate was deliberations on the ways and means to make the rigid eight-hour work day "more elastic" without trespassing on the new rights of the labor classes. In the first stages of the delicate process of readjusting wages on a gold mark basis, the war cry was raised: "Pre-war wages for pre-war efficiency only." Wages were then stated to run considerably ahead of pre-war wages. Firm hands have now taken hold of this important problem, regaining control quickly and to an amazing extent. Backed by the hue and cry for a thorough reform and by dire need, the restraint of the employer's party has broken bounds. The latter is now obviously determined to do complete work. Pre-war wages for pre-war efficiency is being demanded. By pre-war efficiency is meant the restoration of pre-war labor conditions. The present situation is extremely favorable for such retrograde evolution. The labor element has now realized that its revolutionary achievements has not been the blessing it was led to expect. It has had time to pierce through the glittering veil of the ever-increasing figures of its earnings to their concrete value which has not advanced, but steadily dropped behind.

How Labor Feels About It

Labor's resistance now rests chiefly on the allegiance to its dogmas. Even in this respect a change has prepared itself as the levelling process has secretly alienated the best part of the labor element from those dogmas. This part is longing for the old-time differentiation of wages and a fair reward for efficiency and diligence. Besides, the keen edged weapon of the labor classes—the strike—has become quite blunt. The unions' coffers are empty and many manufacturers would rather welcome a strike. The weakness of the labor position was amply evidenced by the fixation of the first gold wages. The employers' organization had repeatedly announced that 75 per cent of pre-war wages constituted the utmost limit to which industry could go. The trade unions were aiming much higher. They claimed the double of pre-war wages, expecting that the usual compromise, which to achieve is the function of the arbitration boards, would land them at a level of about 150 per cent.

The employers are firm, knowing that the first gold wages would establish a standard of rates of a lasting nature and they realized the momentous issue at stake for the shaping of the immediate future. In the contests following, the greater strength is on their side. A number of strikes, under circumstances unheard of since the labor party came into power, have confirmed this fact. The result was that employers have, step by step, retreated from their 75 per cent limit. The first gold wages of the miners have just been adjusted at an average of 4.20 gold mark for the Ruhr and about 2.50 gold mark for the German interior. The strong differentiation made in favor of the Ruhr miners is purely temporary and explained by the exceptional conditions in the district. For a 7½ hour shift, 2.50 gold mark or about 30 pfennigs may be regarded as the standard awarded to that class of workmen. The average in 1913 for a 10 hour shift was 4.00 gold mark or 40 pfennigs. The new rates correspond approximately with 75 per cent of pre-war rates. In subsequent adjustments, a much lower ratio was proposed by the employers. The State administration, the largest employer, is actually engaged in negotiations with the workmen's organization on a basis of from 20 to 27 pfennigs per hour, corresponding with barely 50 per cent of pre-war wages. This is being done at a time when the gold mark has hardly a third of its pre-war purchasing power. The workmen are being consoled by the theory that an increase of the production will again raise the purchasing power of the currency.

The first blood drawn in the contest has brought an easy victory to the employers. Encouraged by this fact, they have now put all their "guns" in position. As would be expected, the Ruhr industrialists have opened the attack. After serving their whole working force with a notice of dismissal, they have forwarded to the unions new stipulations under which they declare to be prepared to take them on again. These new stipulations are in fact old ones drawn up on the lines of pre-war conditions, especially regarding the work-day and piece work payment. The outcome of the struggle now waged around these stipulations is still undecided, but it is a significant fact that they have not been repudiated by the unions and have actually been taken into discussion. The Ruhr industrialists have let it become known that they intend to run only two shifts per day in the future, and that their working forces will be reduced 30 per cent. If they succeed, an example is set for the rest of industry.

The Other Question—Prices

But if there seems to be a solution of the labor question, the price situation is still in a serious state. From the basic products upward, prices have surpassed their corresponding pre-war level. The low wage rates now enforced are resting upon a very fragile foundation. If the price level cannot be screwed down accordingly, the firm ground now almost within reach will be lost. Much is hoped in this respect from the automatic levelling action of a stable currency. Whether the latter alone will be capable to reduce the hot-house growth of prices to a proper size, may be doubted.

Quite unnoticed in the general trouble is an executive order that has been issued supplying the government with a formidable weapon to cut down such exuberances of the inflation period. This order is drawn up along the lines of the United States Anti-Trust bill, but is more far-reaching, and allows swifter action. It enables the government to annul every sort of agreement, verbal or written, tending to unduly raise prices and maintain them at a level detrimental to the public interests. In place of slow legal machinery, a special court is established to deal speedily and thoroughly with all cases brought to its notice.

Personals

JAMES L. GOUGH has been appointed sales manager of the Stoker-Rumely-Wachs Co., Chicago, Ill.

H. P. DUVAL has been appointed representative in the Missouri district for H. D. Conkey & Co., Chicago, Ill. His headquarters will be located at 301 American Bank Bldg., Kansas City, Mo.

CLINTON G. ARMSTRONG, formerly consulting metallurgist for the Chicago Flexible Shaft Co., and research metallurgist of the Western Electric Co., has joined the Calorizing Co., Pittsburgh. He will serve in capacity of sales engineer and will be connected with the Chicago office of the Calorizing Co.

HOLLIS T. WALDO has resigned his position with the Goulds Manufacturing Co., and has opened an office in Haverhill, Mass., as an hydraulic engineer.

LOUIS R. KRUGER has resigned as general superintendent and mechanical engineer of the Cruver-Peters Co., Chicago, Ill., and has accepted a position as mechanical engineer and adviser to Mrs. Chas. Stein of California. His new address is 805 Bush St., San Francisco, Calif.

S. A. GILLIARD has been appointed sales agent for H. D. Conkey & Co., Chicago, Ill., in the Buffalo, N. Y., district. His headquarters will be at 405 Liberty Building.

J. HUBERT DOUGHERTY, who for seven years has been manager at Toronto for the General Supply Co. of Canada, Ltd., has been transferred to the management of that company's office in Montreal. W. H. QUA, who has been with the company for the past four years, succeeds Mr. Dougherty in charge of the Toronto office.

WILLIAM W. COCHRAN, automobile body expert, who recently returned from an inspection of European motor car factories and body plants, has been appointed superintendent of the Wills-Sainte Claire trim shop at Marysville, Mich.

H. C. KEYSOR has been made works engineer at the Pittsburgh plant of the American Steel Foundries Co. Mr. Keysor for the past four years has been employed at the Alliance, Ohio, plant of the same company, acting as special investigator, assistant foundry foreman and inspector.

Obituary

JULIUS C. BIRGE, vice-president of the Ames Shovel & Tool Co., St. Louis, Mo., died recently in that city.

WILLIAM H. COOLEY, treasurer of the New York Car Wheel Co., Buffalo, N. Y., died recently at his home in that city.

ANTONIO C. PESSANO, chairman of the board of directors of the Great Lakes Engineering Works, Detroit, Mich., died recently in New York City.

GEORGE DUDLEY LOOMIS, aged 77 years, is dead at his home in Tiffin, Ohio. He was president of the Loomis Machine Co. and was also identified with many other metal working plants in that locality.

STEPHEN C. MASON, president of the National Association of Manufacturers from 1918 to 1921, died recently at his home in Pittsburgh, Pa., as a result of dilation of the heart. He was 62 years of age. He was secretary and director of the McConway & Torley Co. since 1896 and was widely known in railroad circles.

EDWARD L. THOMAS, president of the Thomas Grate Bar Co., died at his home in Birmingham, Ala., recently after an illness of several weeks. Mr. Thomas was formerly of Valdosta, Ga., going to Birmingham some years ago at which time he established the above company. He was the inventor of the patent grate bar which this company manufactured.

RALPH E. GILMAN, special engineer in charge of turbo-generator engineering of the Westinghouse Electric & Manufacturing Co., died in the Methodist Hospital, Los Angeles, Dec. 5.

Discuss Standards for Page Sizes

A special committee on size of publications for standards of the American Engineering Standards Committee met on Dec. 13, under the chairmanship of Henry M. Hobart, consulting engineer of the General Electric Co., at the Engineering Societies building to discuss standard sizes for publications dealing with standards as published by engineering societies. While the work of this committee does not deal directly with the sizes of sheets as made by the paper mills, it is largely dependent on the sizes if waste in trimming is to be avoided. This committee ties up the sizes of sheets with the work done at the Bureau of Standards looking toward the simplification of paper sizes. The Bureau found that, although there were 333 sizes made, 90 per cent of the publications printed could be handled by 4 sizes of sheets.

The standards recently adopted by the Germans were shown and, while these are not far from the sizes which will probably be adopted in this country, they are enough different to give a sheet of different proportions than we are accustomed to see, and one that would not file easily in our standard filing cabinets. This is to be regretted because the German standards have also been adopted by Austria, Switzerland and Holland and are also being seriously considered by the Belgians.

This question of size has long been studied in this country and there is a strong tendency toward the adoption of 7¾x10⅝ in. as the standard size for engineering codes, data, etc. There is a tolerance of ¼ in. for variation in trimming. Folding this once gives 5 5/16x7¾ in. for pocket literature, and this size is also being used in many cases. These sizes are cut from the standard 32x44-in. sheets with the usual trimming.

While no direct recommendations were made, it was the sense of the meeting that the size of 7¾x10⅝ in. was best for the publication of engineering data and standards, except for pocket use.

Business Items

With a capitalization of $200,000, the H. J. Logan Co., Toronto, Canada, has been incorporated to manufacture and deal in machinery, by Robert Wherry, William Zimmerman and W. H. Osborne.

The correct address of the Chicago office of the Van Dorn Iron Works Co., Cleveland, Ohio, is 167 Monroe St.

The Steel Products Corp., Sheboygan, Wis., recently incorporated with $100,000 capital, has perfected its organization by the election of the following named officers: President, A. G. Stuedeman; vice-president, Robert C. Ebenreiter; secretary and treasurer, Fred Zschetzsche.

The Marathon Battery Co. of Wausau, Wis., has been incorporated with a capital stock of $150,000 for the purpose of engaging in the manufacture of storage batteries, dry batteries, electrical devices and appliances, equipment and general electrical merchandise. The incorporators are W. H. Thom and Edgar J. McEachron of Wausau, and E. A. Fuller of Madison, Wis.

The plant and equipment of the Hercules Steel Casting Co. of Milwaukee is being offered for sale by E. L. Cullen, receiver, 871 Robinson Ave., Milwaukee. Bids are now being received and will close Jan. 21, 1924, at 5 p.m. The corporation was placed in charge of a receiver by the state courts several months ago. The equipment includes a 10-ton tilting electric furnace and all appurtenances, including electric cranes, core ovens, iron and wood flasks, welding torches, etc. The capacity is 300 tons a month, with a payroll of 100 men. There is a pattern and carpenter shop, pattern storage vault and a warehouse building.

The General Machinery Co., Spokane, Wash., has been appointed representative for the Eastern district of the state of Washington for the Chicago Pneumatic Tool Co., New York City.

J. E. Rhoads & Sons, leather belting manufacturers, have opened a store in Atlanta, Ga. The main office for the concern is in Philadelphia.

The Brock Engineering Corp. has received incorporation papers from the Secretary of State of Missouri. The company will manufacture and deal in steam boilers. The capital is to be $100,000. The incorporators are: Edward J. Brock, A. J. Brock, V. D. Sears and C. B. Brockett. Offices have been opened in the Arcade Building, St. Louis, Mo.

The Western Tool & Wrench Co., of San Francisco, has been incorporated with a capital stock of $50,000. The directors are: A. W. and Herman Peterson and John Henry.

The Wausau Motor Parts Co. of Wausau, Wis., a new $50,000 corporation, has been organized to take over the entire business and interests of the Menominee Piston Ring Co., of Menominee, Mich. The plant and equipment is being transferred to Wausau and installed in a leased building. Additional purchases of machinery are contemplated, as in addition to piston rings the Wausau concern intends to manu-

facture pistons and other motor and engine replacement parts. Later general automobile accessories will be manufactured as well.

The C. W. Rood Engineering Co., Wisconsin Rapids, Wis., is engaging in the manufacture of machinery as a development of its general engineering practice, and has taken over the Johnson & Sons Machine Co. of the same city. A new shop is being set up in one of the large factory buildings of the F. McKinnon Co., manufacturer of wagons and automobile bodies. The machinery acquired from the Johnson company will be materially supplemented. The Rood company will specialize in the construction of hoisting and excavating machinery, continuing also the Johnson company's policy of building custom machinery.

The Prime Mfg. Co., 653 Clinton St., Milwaukee, manufacturer of brass castings, hardware specialties, automobile trunks, etc., has engaged Frank D. Chase, Inc., engineer, Chicago, to make plans for its proposed new brass foundry, to be 60x120 ft., fireproof, and cost about $65,000 with full equipment.

The Northwestern Fence & Wire Co., Milwaukee, has been incorporated under the laws of Wisconsin for the purpose of manufacturing and dealing in all kinds of wire goods. The capital stock is $50,000 and the incorporators are Daniel V. Holcomb, John Selbo and William Clark. The company has established offices at 290 Third St.

The organization of a new company to succeed the Anderson Foundry & Machine Co., a subsidiary of the R. L. Dollings Co., Anderson, Ind., has been agreed upon by committees representing stockholders and creditors of the company. The joint committee by resolution appointed a subcommittee, consisting of Bert McBride, of Indianapolis, receiver for the R. L. Dollings Co. in Indiana; William O. Barnard, Newcastle; Emerson McGriff, Portland; William S. Diven and Charles K. Pagot, of Anderson, to handle the reorganization affairs.

Trade Catalogs

Power Piping Systems. The Pittsburgh Valve, Foundry & Construction Co., Pittsburgh, Pa. A particularly interesting booklet on power piping systems has been issued by this company. It contains forty 8½x11-in. pages exceptionally well illustrated and the various parts of the Atwood power piping system concisely but clearly described. Standard specifications for power piping are given and there are tables of dimensions to be found as well.

Electric Controlling Apparatus. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. The catalog containing bulletins with prices and dimensions of electric controlling apparatus has been issued by this company for November.

Automatic Machines. The Cleveland Automatic Machine Co., Cleveland, Ohio. Production Bulletin No. 4 is the title of this booklet in which the various machines and parts for machines are illustrated and described.

Flexible Couplings. Smith & Serrell, Central Ave. at Halsey St., Newark, N. J. The Francke flexible coupling for direct-connected machines are described and sectional, charted and "close-up" photographs are to be found in the booklet as well as charts and tables of sizes and dimensions.

Small Tools and Gages. Catalog No. 11. The Pratt & Whitney Co., Hartford, Conn. All of the small tools produced by this company are listed in this 494 page catalog. Tables, charts and prices are also to be found.

Pamphlets Received

The Annual Report of the Director of the Bureau of Foreign and Domestic Commerce. Department of Commerce, Washington, D. C. The report this year, 1922-1923, differs from the preceding similar reports in several important particulars. It records an unprecedented demand for the services and assistance from the bureau, nearly a million requests having been received in the course of the year. A notable advancement has been made in the quality of the Bureau's statistical services during the year. Contacts between the Bureau and those whom it serves in business have been made more direct and helpful, it is pointed out in the report, and other features that have made the department of greater value are listed and described.

Emergency Braking on Electric Cars. D. D. Ewing. Bulletin of Purdue University, Lafayette, Ind. This is bulletin No. 13 of the Engineering Experiment Station of the University containing 163 pages devoted to observations on the subject, summaries of test data, illustrations showing various experiments and many charts showing the results of emergency braking where tests have been carried out.

Annual Report of the Director of the Census. Government Printing Office, Washington, D. C. This report covers the fiscal year ending June 30, 1923, and is made to the Secretary of Commerce. General and special censuses, including industrial statistics, and the work of collecting these data, is clearly but briefly told.

What's Ahead for American Business? P. F. McDonald & Co., Boston, Mass. Expressions of opinion as to the trend of business are contained in this booklet. Such men as Charles M. Schwab, E. M. Herr, Elbert H. Gary, Roger W. Babson, George M. Verity, H. B. Thayer, Charles L. Allen, Howard Coonley, and others are quoted.

Readjustment of Relative Freight Rate Schedules. United States Chamber of Commerce, Washington, D. C. This is the report of Special Committee No 3 and the case of the present rates and the need for readjustment are reported.

An Employee's View. H. E. Core, general chairman, Brotherhood of Locomotive Firemen and Enginemen, Pennsylvania R.R., Philadelphia, Pa. How the plan of employee representation on the Pennsylvania R.R. is actually working, is reported in this booklet which contains the speech that Mr. Core recently delivered at the New York Railroad Club. He describes the amicable settlement of industrial disputes by the methods in effect on this railroad as "amazing."

Engineering Education and American Industry. National Industrial Conference Board, 10 East 39th St., New York City. This is special report No. 25, in which the subject of engineering education is told in detail. The booklet is divided into three parts: "The Need for Trained Leadership in Industry"; "The Educational Problem"; and "The Responsibility of Industry." Other headings are: "The New Problems of Industry"; "The Present Requirements of Industry"; "Future Requirements"; "The Kind of Talent Necessary"; "The Engineering School"; "Tendencies of Engineering Graduates"; "Developments in Engineering Courses"; "Suggestions for Industrialists"; "Training in Fundamentals"; and "Selection and Classification of Students."

The De Bothezat Barograph, Type "A." Published by the Chief of the Air Service, Washington, D. C. W. F. Gerhardt has prepared this paper which is one of the series of Air Service Information Circulars. He is of the engineering division of McCook Field, Dayton, Ohio. The general features of the mode of operating the Barograph are outlined. Half-tone illustrations, charts and tables of interest to readers are to be found in the booklet.

Shall the United States Enter the International Labor Organization? Magnus W. Alexander, M. W. Alexander, 10 East 39th St., New York City. This is a reprint from the *New York Times* of Feb. 25, 1923, in which Mr. Alexander who is managing director of the National Industrial Conference Board sets forth both sides of this interesting question.

Anti-Friction Bearings in the Steel Mills. A. M. McCutcheon, Chief Engineer, the Reliance Electric & Engineering Co., Cleveland, Ohio. This paper was presented before the Association of Iron and Steel Electric Engineers and is an exhaustive survey of the subject.

Power and Its Application from the Seventeenth Dynasty to the Twentieth Century. The Morse Chain Co., Ithaca, N. Y. This is an address delivered by F. L. Morse at the twenty-sixth annual convention of the American Mining Congress held in Milwaukee, Wis., during September. The pamphlet is profusely illustrated with reproductions of etchings and drawings of the ancients showing the various crude methods of power and the improvements that have been made up to the present day of belts, shafting and chain drives.

Final Report of the Federal Fuel Distributor to the President of the United States. Government Printing Office, Washington, D. C. The work of F. R. Wadleigh, Federal Fuel Distributor, and how it has been carried out, is told in this government pamphlet. There are many tables showing coal production, distribution and other data of general interest.

Visibility of Radiant Energy. K. S. Gibson and E. P. T. Tyndall. Published by the Department of Commerce, Bureau of Standards, Washington, D. C. This is a scientific paper of the Bureau of Standards, No. 475, and contains valuable data, charts, tables and text pertaining to the subject.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Machinery. Landskrona, Sweden. Agency. Reference No. 8432.

Machines and supplies for various industries. Harbin, China. Purchase. Reference No. 8470.

Pumps and pump and pipe fittings. Habana, Cuba. Agency. Reference No. 8418.

Tools in general and interchangeable wrench sets. Nantes, France. Reference No. 8421.

Tools and precision apparatus. Bucharest, Rumania, Purchase and agency. Reference No. 8409.

Forthcoming Meetings

American Society for Steel Treating. Winter sectional meeting. Hotel Seneca, Rochester, N. Y., Jan. 31 and Feb. 1. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual meeting, Jan. 22 to 25, at the General Motors Building, Detroit, Mich. Coker F. Clarkson, 29 W. 39th St., secretary.

American Gear Manufacturers Association. Spring Meeting, April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y.

Society of Industrial Engineers. Eleventh annual convention, Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Dividion V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

The Lyons Fair. Lyons, France, March 3 to 17, 1924. Information furnished by Emile Garden, 50 Church St., New York City.

New and Enlarged Shops

Machine Tools Wanted

Conn., Bridgeport—A. L. Clark Co., 1710 Main St.—equipment for $150,000 proposed machine shop and service station.

Conn., Middletown—School Bd. E. B. Sellew, Supt.—wood and metal lathes, machine shop equipment, etc., for trade school.

Ill., Chicago—Union Pacific R.R., 58 East Washington St., G. C. Smith, 15th and Dodge Sts., Omaha, Neb., Purch. Agt.—about seventeen machine tools, including engine lathes, drill and bushing presses, grinder, drills and boring mills.

Ill., Peru—W. H. Maze Co.—18 in. shaper and belting for machine shop.

Ill., Rockford—Automotive Corp., 315 South Church St.—drill press and chain hoist for garage.

Kan., Frontenac—Fuertsch Garage—hand tools and drill press.

Kan., Girard—Central Garage, 202 South Ozark Ave., E. S. Couder & Son, Purch. Agts.—drill press and 14 in. x 6 ft. lathe.

Kan., Girard — County Garage, C. M. Cooper, Purch. Agt.—drill press; 18 in. x 12 ft. lathe; regrinding and reboring machine; line shaft; motor burning in machine.

Kan., Girard—W. J. Farrell, 220 South Ozark Ave. (electric and automobile service)—drill press.

Kan., Girard—North Side Garage, North Side Sq., D. R. Jones, Purch. Agt.—drill press and post drill.

Kan., Girard — W. Shivner, 205 North Cherokee St.—12 in. x 8 ft. lathe.

Kan., Girard—Snow's Machine Shop, 109 North Ozark Ave., S. R. Snow, Purch. Agt.—stamp machine.

Kan., Pittsburg — Deckard Steel & Iron Co., 4th and Smelter Sts., C. L. Deckard, Purch. Agt.—milling machine, standard dies.

Kan., Pittsburg—Pittsburg Boiler & Machine Wks., A. Sikesetter, Purch. Agt.—hand tools, planers, air tools, shapers and tools for heavy machine work.

Mich., River Rouge—Whitehead & Kales, 58 Haltiner St., H. C. Vance, Purch. Agt.—high speed drill, one heavy type plain production and one hand milling machine.

Minn., St. Paul—Siems-Stembel Co., 2600 Como Ave., G. Zak, Purch. Agt.—punches, shears, air compressors, drills, hydraulic press, etc., for car building and repair shops.

Mo., Pierce City—Stuckey Auto Co., D. E. Stuckey, Purch. Agt.—drill press and lathe (used).

N. J., Newark—Bd. Educ., R. D. Argue, Secy.—receiving bids until Dec. 27 for sheet metal shop machinery, pumps and valve reseating outfit, etc.

N. Y., Baldwinsville—Penn Spring Wks., Lock St.—machinery and equipment, including automatic machine tools, for addition to factory for the manufacture of automobile springs and bumpers.

N. Y., Binghamton—J. Shulman, 22 Collier St.—garage repair shop tools and equipment.

N. Y., Buffalo—F. C. Brindler, 228 Ideal St.—equipment for garage repair shop.

N. Y., Buffalo—Buffalo Genl. Electric Co., River Rd.—complete machine shop machinery and equipment to replace fire loss.

N. Y., Buffalo—Federal Addressing Machine Corp., 11 Goodell St.—No. 1 milling machine and 16 in. x 8 ft. lathe, quick change gears.

N. Y., Buffalo—P. E. Green, 230 North St.—equipment for garage repair shop.

N. Y., Buffalo—E. Lowry, 175 North St.—equipment for garage repair shop.

N. Y., LaFargeville—E. Schell—acetylene welding outfit, drill press and tools for garage repair shop.

N. Y., Utica—Dairyman's League, Wurz Ave.—tools, vise and equipment for automobile repair shop.

N. Y., Utica—R. Metzger, Lafayette St.—machinery, tools and equipment for automobile repair and paint shop.

N. Y., Watertown—Northrop Motor Co., 123 Benedict St., S. B. Northrop, Purch. Agt.—tools and equipment for expansion program.

O., Cincinnati—J. Steptoe Co., 2951 Colerain Ave.—bevel gear cutter andgear hobbing machine for gears up to 24 in. diameter (used).

O., Columbus—F. Girard Co., 196 East Gay St.—two electric drills, press, grinder, etc., for new service station.

O., Youngstown—H. Steinfurth, Wirt St.—machinery, tools and equipment for repair and machine shop.

Pa., Allentown—P. Bower, 632 North 8th St.—tools and equipment for garage repair shop.

Pa., Allentown — Quick Service Garage, Rear 131 North 7th St., C. H. Kemmerer, Purch. Agt.—lathe, tools and equipment for repair shop.

R. I., Pawtucket—New England Machine & Electric Co., 31 Bayley St.—large and small machine tools for proposed $25,000 shop.

Wis., Appleton—Kurz Motor Car Co., 1107 College Ave.—automobile repair machinery, chain hoist and small tools.

Wis., Lakemills — Overland Garage Co., c/o O. W. Farmer, Mgr.—automobile repair machinery, small tools, gasoline tanks and pumps for proposed $40,000 garage.

Wis., Madison—L. F. Schollkopf, 210 East Washington Ave.—drill press, chain hoist and small tools for repair shop.

Wis., Milwaukee—Amer. Plier & Tool Corp., c/o O. L. O'Boyle, 221 Grand Ave.—machine tools, including grinder and drill.

Wis., Mondovi—Hardy Motor Co., W. J. Hardy, Mgr.—automobile repair machinery, small tools, gasoline tanks and pumps for proposed garage and repair shop.

Wis., Oconto—E. W. McAllister (machinist)—boring machine and drill press.

Wis., Oshkosh—Oshkosh Mfg. Co., 412 South Main St.—punch and shear, capacity ½ x 2 in. mild steel.

Wis., Ripon — Advertisers Mfg. Co. — special metal working machinery for the manufacture of metal advertising signs, etc.

Wis., Sheboygan—Jenkins Machine Co., South 8th St.—special machinery for the manufacture of woodworking tools and machinery.

Wis., Sheboygan — Steel Products Corp., 426 Grant St., F. Zschetzche—special machinery, including shears, hacksaws, drills, grinders and presses, for foundry for the manufacture of automobile bumpers.

Ont., Cornwall—L. Brunet, Montreal Rd.—bench lathe for automobile repairs.

Ont., Moose Creek—T. Dewar—lathe for garage.

Ont., Wakefield — Joyce Bros. — press, tools, etc., for automobile repair shop.

Ont., Wiarton—W. McCrabb—tools and machinery for proposed $40,000 garage and repair shop, to replace that which was destroyed by fire.

Ont., Woodstock—Bickle Fire Engine Co.—metal working machinery, tools, etc., to enlarge plant.

Que., Montreal—J. G. Berthiaume, 2878 St. Lawrence Blvd.—automoblie repair machinery.

Que., Montreal—E. Brunelle, 341 Alwin St.—tools and equipment for garage.

Que., Montreal—J. A. Dufresne, 692 Albert St.—equipment for automobile repair shop.

Que., Montreal—A. Dussault, 367 Jeanne d'Arc St.—equipment for garage repair shop.

Que., Montreal—J. Escata, 792 Berri St.—tools and equipment for automobile repairs.

Que., Montreal — Hamelin & Frere, 1821 Notre Dame St.—repair tools and equipment for garage.

Que., Montreal—J. T. Repair Shop, 654 Drolet St., A. Jones, Purch. Agt.—tools and general equipment for automobile repair shop.

Que., Montreal — A. Laurin, 2320 Blvd. Gouin, W.—small lathe for automobile repair shop.

Que., Montreal — J. Leclerc, 1481 St. Dominique St.—repair tools, press, etc., for garage.

Que., Montreal—L. Poitras, 2535 Clarke St.—equipment, tools and emery wheel for garage.

Que., Montreal—L. Rottella, 1666 Papineau Ave.—garage and repair equipment.

Que., Montreal—H. Signori, 631 Dorchester St., E.—machinery and equipment for garage.

Que., Montreal—F. Stephens, 11 Duluth Ave., E.—tools and equipment for garage.

Machinery Wanted

Calif., Oakland—R. C. Durant, 10910 East 14th St. and A. G. Waddell, 346 Hanover St.—machinery and equipment for proposed plant for the manufacture of transmissions for Star motor cars at Los Angeles.

Conn., Hartford—Standard Mattress Co., 711 North St.—steel conveyors for proposed $40,000 factory.

D. C., Wash.—Bureau of Yards & Docks, Navy Dept. — laundry equipment for Brooklyn.

Ill., Forest Park (Oak Hill P. O.)—H. Huxhold—one large air compressor.

Ia., Bayard—Bulletin—10 x 15 in. or 12 x 18 in. job printing press.

Kan., Girard—Electric Shoe Shop, South Side Sq., L. H. Harmon, Purch. Agt.—nailing machine.

Kan., Girard—Girard Garage, 212 South Ozark Ave., R. Morris, Purch. Agt.—electric drill for automobile repairs.

Kan., Kansas City—Pouton Bros., Wyandotte St., between 10th and 11th Aves.—Miehle perfecting press.

Kan., Pittsburg—When Shoe Shop, 422 North Bway., F. P. Wadlow, Purch. Agt.—shoe nailing mahine.

Kan., Wichita—T. F. Roy, 113 North Osage St. (cabinet maker)—one 6 in. and one 8 in. jointer, also pony planer.

Me., Rockland—School Com.—wood and metal working machinery for manual training department of new high school.

Md., Glenelg — G. H. Paul — linotype, cylinder press, one 8 x 12 in. and one 12 x 18 in. job printing press, automatic feeders, folder, multicolor printing press, card press, stitcher, miter, paper cutter, Ludlow machine, monotype machine, saw and metal cutter.

Mass., East Boston (Boston P. O.)—Boston Sand & Gravel Co., 300 Condor St.—electric coal hoist and tower with thru boom, to handle 1¼ yd. bucket; possibly electric traveling crane, 60 ft. boom (used preferred).

Mass., Unionville—Ray Cotton Mills—several picking machines.

Mich., Detroit—Detroit House of Correction, 1441 Alfred St., E. Dennison, Supt.—cooling room, washing room and bottling equipment, also refrigerating system, sterilizing plant, etc., for milk house for farm at Plymouth.

Mich., Highland Park (Detroit P. O.)—Ford Motor Co.—mechanical equipment, including conveyors and material handling equipment, for proposed assembly plant at Jacksonville, Fla.

Miss., Belzoni—The city, F. M. Pepper, Clk.—receiving bids Jan. 10 for coal conveying machinery, etc.

Mo., Granby—Weekly News Herald, G. W. Dugan, Purch. Agt.—newspaper cylinder press and paper cutter (used preferred).

Mo., Kansas City—Acme Filling Sta., 2733 McGee St.—air compressor and tank.

Mo., Kansas City—Unity Publishing Co., 9th St.—Miehle perfecting press.

Mo., Pierce City—W. B. Jones Publishing Co.—paper cutter, Miller job press and feeder (used)

Mo., St. Charles—St. Charles Sand Co.—10 ton truck scale.

Mo., Seneca—W. R. Dutton—newspaper press, belting, hangers, pulleys and shafting.

N. Y., Albany—Williams Press, Inc., Market Sq., D. L. Williams, Pres.—one sheet feed rotary press similar to Cottrell make.

N. Y., Boonville—A. C. Capron—complete machinery and equipment for proposed feed mill and cold storage plant, to replace that which was destroyed by fire.

N. Y., Buffalo—Buffalo Fdry. & Machine Co., 1543 Fillmore Ave.—equipment.

N. Y., Buffalo—E. Herrmann, 267 Elm St.—laundry equipment.

N. Y., Buffalo—J. Ricotta, 463 Front Ave.—equipment for concrete block factory.

N. Y., Buffalo—S. White, 382 Sycamore St.—equipment for concrete block factory.

N. Y., Buffalo — J. P. Ziemiacki, 116 Howell St.—equipment for concrete block factory.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Improvement in demand for basic pig iron. Reserve iron stocks getting low; price advance anticipated. Little importing being done owing to comparatively low price of American iron. Steel prices continue firm. Bars not under $2.40 per 100 lb. at mill. Shapes unchanged at $2.50 base. Firmness in nuts, bolts, rivets, etc., at Pittsburgh mills. Consumers' stocks low owing to inventory. Better demand expected at beginning of new year.

Advances—Copper demand improved; price of electrolytic up ¼c. per lb. in week. Lead market strong; advanced ¼c. per lb. Tin prices tending upward.

Declines—Zinc market easier; quotations about 15c. per 100 lb. below those of a week ago. Antimony quiet; no change in price. Furnace coke down about 50c. and foundry, 25c. per ton in week.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	2.90@3.00	4.34	3.75	4.00
No. 12	3.00@3.10	4.39	3.80	4.05
No. 14	3.10@3.20	4.44	3.85	4.10
No. 16	3.30@3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.30@4.55	4.45	4.70
Nos. 22 and 24	3.75	4.35@4.60	4.50	4.70
Nos. 25 and 26	3.80	4.40@4.65	4.55	4.75
No. 28	3.85	4.50@4.75	4.65	4.85
Galvanized				
Nos. 10 and 11	3.85@4.00	4.50@4.80	4.70	4.85
Nos. 12 and 14	3.95@4.10	4.60@4.90	4.80	4.95
Nos. 17 and 21	4.25@4.40	4.90@5.20	5.10	5.24
Nos. 22 and 24	4.40@4.55	5.05@5.35	5.25	5.40
No. 26	4.55@4.70	5.20@5.45	5.50	5.55
No. 28	4.85@5.00	5.50@5.75	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	⅞	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00		
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.87½
Tin, 5-ton lots, New York			48.87½
Lead (up to carlots), St. Louis	7.40	New York	8.12½
Zinc (up to carlots), St. Louis	6.25	New York	6.60

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	27.00	28.50
Antimony (Chinese), ton spot	9.75	10.50	10.25
Copper sheets, base	21.00	21.00@21.25	23.00
Copper wire, base	16.25	19.00	16.25
Copper bars, base	20.00	22.50	19.50
Copper tubing, base	23.50	27.25	23.00
Brass sheets, base	17.75	22.00	18.75
Brass tubing, base	22.00	27.00	20.50
Brass rods, base	15.50	18.00	15.75
Brass wire, base	18.25	22.00	
Zinc sheets (casks)	10.25	10.45	
Solder (½ and ½), (case lots)	33.75	31.75	30.00
Babbitt metal (83% tin)	52.00	59.50	48@52
Babbitt metal (35% tin)	25.00	18.50	22@25
Nickel (ingot and shot)	29.00		
Nickel (electrolytic)	32.00		35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.75	11.00	11.50
Copper, heavy, and wire	10.75	10.50	10.75
Copper, light, and bottoms	9.50	8.75	9.75
Lead, heavy	5.75	5.25	6.00
Lead, tea	4.75	4.00	5.00
Brass, heavy, yellow	7.00		7.25
Brass, heavy, red	8.75	9.25	9.00
Brass, light	6.25	5.00	6.25
No. 1 yellow brass turnings	7.00	5.75	6.75
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.11@0.14	$0.15	$0.14
Cotton waste, colored, per lb.	.09@.14	.12	.10½
Wiping cloths, 13¼x13¼, per lb	9.00	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.		52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.95	1.00	.94
Lard cutting oil, 25% lard, per gal.	.55	.50	.67½
Lard oil, pure, per gal, 2 to 5 bbl. lots	.76	.73	.71
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.297	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5–2½	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		4.00@4.40
Coke, prompt foundry, Connellsville	per net ton		5.25@6.50
White lead, dry or in oil	100 lb. kegs		New York, 14.00
Red lead, dry	100 lb. kegs		New York, 14.00
Red lead, in oil	100 lb. kegs		New York, 15.50

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.044	0.0465	0.039
Brass rods	per lb	0.155	0.1475	0.17
Solder (½ and ½)	per lb.	0.3375	0.31	0.275
Cotton waste	per lb.	.11@.14	.10@.13	.09@.11½
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.50
Machine oil	per gal.	0.297	0.297	0.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts up to 1x30 in.	off list	45%	40–10%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1¼ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	
Hex. head and hex. nut bolts	List net		65–5%
Lag screws, coach screws	45%		60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	50%	50–5%
Bolt ends, with hot pressed nuts	45%		55%
Tap bolts, hex. head, list plus	35%		
Semi-finished nuts, $\frac{9}{16}$ and smaller	65%		
Semi-finished nuts, ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%		
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1⅛ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25		0.15
⅜ in. diameter *EXTRA*	0.35		0.15
½ in. diameter *EXTRA*	0.75		0.50
1 in. long, and shorter *EXTRA*	0.75		0.50
Longer than 5 in. *EXTRA*	0.50		0.25
Less than 200 lb. *EXTRA*	0.50		0.50
Countersunk heads *EXTRA*	0.45		$3.70 base

N. Y., Madrid—W. Griffith—machinery and equipment for plant for the manufacture of condensed milk, etc., at Massena.

N. Y., New Hartford—Utica Coca Cola Bottling Co., E. C. Baker, Purch. Agt.—bottling machinery and equipment.

N. Y., New York—Cuba Cane Sugar Corp., 112 Wall St.—equipment, including crystallizers, etc., for proposed $200,000 raw sugar mill at Velasco, Cuba.

N. Y., Penn Yan—B. H. Rogers—machinery and equipment for proposed shop for the manufacture of building materials.

N. Y., Rensselaer—W. Barnet & Son, Inc.—rag picker, condenser and garnet machine for cotton goods.

N. Y., Utica—Deutsche Zeitung, 18 Elizabeth St., R. Metzler, Purch. Agt.—presses and equipment for proposed $10,000 newspaper plant.

O., Greenville—City Bakery—complete equipment for proposed bakery.

O., Paulding—Foreman Blacksmith Shop, C. Foreman, Purch. Agt.—tools and equipment to replace fire loss.

O., Toledo—H. H. Nelson, 153 Utah St.—equipment, including hoisting machinery, for new automobile paint shop.

Okla., Drumright—L. S. Allard—duplex press, one No. 8 and one No. 14 linotype machine.

Ore., Portland — Oregon Amer. Lumber Co., 1017 Yeon Bldg., C. W. McGregor, Mgr.—machinery for proposed saw and planing mill at Vernonia.

Pa., Allentown—Amer. Beauty Silk Co., Meadow and Allen Sts.—machinery, looms and special equipment for proposed addition to plant for the manufacture of artificial silk.

Pa., Bloomsburg—Garrahan Canning Co.—complete machinery and equipment for proposed plant.

Pa., Erie—Natl. Organ Supply Co., 17th St. (manufacturer of organ parts)—machinery and equipment, including hangers, belting, etc., for proposed factory addition.

Pa., Hallstead — E. Tiffany, Main and Franklin Sts.—machinery, tools and equipment for proposed plant for the manufacture of tree trimmers and specialties.

Pa., Pittsburgh—Amer. Sheet & Tin Plate Co., Frick Bldg., M. T. Dennis, Purch. Agt.—15 or 30 ton electric crane.

R. I., East Greenwich—Greenwich Mills—several looms for addition to woolen mills.

Tex., Clarendon—J. C. Estalick—job printing press, paper cutter, belting, hangers and pulleys.

Tex., San Antonio—L. Harrington Co., Houston Bldg.—machinery and equipment, including crusher, washer, screens, etc., for proposed crushing plant at Salado.

Tex., Sherman—J. Beerman, Box 736—newspaper press and complete equipment.

Tex., Slaton—Job Printer, Box 142—job printing press, belting, pulleys and hangers (used).

Wis., Cambridge—Webster Candy Co., A. E. Meister, Purch. Agt.—candy making machinery, including dippers, pulling machine, kettles, etc.

Wis., Kenosha—C. L. Holderness, 913 Charles St.—rock crushing machine.

Wis., La Crosse—La Crosse Rubber Mills Co., Indian Hill—special rubber working machinery, etc., for proposed addition to factory.

Wis., Madison—Bd. Educ., F. W. Jackson, 22 West Dayton St., Business Mgr.—small mortiser for manual training department of Central High School.

Wis., Madison—Mead & Seastone, Journal Bldg.—electric hoists for penstocks of hydro-electric plant at Caldron Falls.

Wis., Madison—L. J. Schultz, 1326 West Washington Ave.—8 in. sticker.

Wis., Madison — State Bd. of Control, Capitol Bldg., E. Kading, Pres.—refrigeration equipment, dish washing machinery, etc., for refectory at Union Grove.

Wis., Madison—M. B. Witt, 2215 Hollister Ave.—gasoline storage tanks and pumps for proposed filling station on Monroe St.

Wis., Marshfield—Loisell Bros. (garage)—chain hoist and air compressor, electric or gasoline engine power.

Wis., Milwaukee—F. R. B. Mfg. Co., 1296 Forest Home Ave., A. E. Fenrig, Purch. Agt.—woodworking machinery, including sticker.

Wis., Milwaukee—J. M. Tice, 570 Prospect Ave. (woodworking)—one portable saw rig.

Wis., Milwaukee—M. Weinreis, 246 Oregon St.—one caterpillar crane.

Wis., Milwaukee—H. Wiesner, 1433 Prairie St.—air service equipment, emery wheel and stand.

Wis., Milwaukee—Yunker-Hansen Sales Co., 6516 Greenfield Ave.—gasoline storage tanks and pumps for proposed $40,000 garage.

Wis., Richland Center—A. V. Robinson—one large air compressor and one belt conveyor.

Wis., Sheboygan—Evergreen City Broom Co., c/o G. Paykel, 628 North 8th St.—broom making and wire working machines.

Wis., Spooner—J. R. Allen—rock crushing machinery and screening plant for gravel pit.

Wis., Wausau—Wausau Memorial Hospital, c/o G. B. Heineman, 201 1st St.—dish washing machinery, sterilizers, etc., for new hospital.

Wis., Wauwatosa—G. Siewert, Route 2—cement block making machinery, including power tampers.

Wis., West Bend — Atlantic & Pacific Products Co., c/o H. M. Clark, Mgr. — sterilizing equipment and special machinery for new condensery.

N. S., Yarmouth—Yarmouth Cold Storage Co., Ltd., A. W. Eakins, c/o Parker-Eakins Co., Ltd., Purch. Agt.—complete equipment for new $75,000 cold storage plant.

Ont., Chapleau—Austin & Nicholson—sawmill equipment.

Ont., Clinton—M. G. Ransford—pans and general salt handling equipment for plant at Exeter.

Ont., Niagara Falls—Fagen & Co., Northcott Bldg., Queen St.—machinery for new plant for the manufacture of auto wire.

Ont., St. Catherines—Coniagas Mines Ltd., J. J. Mackau, Secy., M. Reid, Cobalt, Genl. Mgr.—mining machinery.

Ont., Spanish Station—Graham & Wilkinson—sawmill equipment.

Ont., Toronto—Consolidated West Dome Lake Mines, Ltd., C. H. Manaton, 420 Bank of Hamilton Bldg., Purch. Agt.—mining machinery, supplies and equipment for South Porcupine.

Ont., Welland—Welland Steel Casting Co.—special equipment.

Que., Calumet—W. Filoon—machinery for the manufacture of ensilage carrier.

Que., Dixie—R. T. Donaldson—equipment for the manufacture of automobile radiator shutters.

Que., Montreal — H. E. Bourassa, 700 Demontigny St., E.—machinery and equipment for tire repair shop.

Que., Montreal—Canadian Auto Radiator Co., Ltd., 1218 St. Denis St.—welding outfit.

Que., Montreal — J. Desrosiers, 269 Christopher Columbus St.—moulders and saws for sash and door factory.

Que., Montreal—Imprimerie Maisoneuve, 478 Lasalle Ave.—equipment for job printing plant.

Que., Montreal — A. Montpetit, 3084 St. Hubert St.—vise and other equipment for automobile repair shop.

Que., Montreal—N. Pariseau, 2666 27th Ave. (doors, etc.)—surfacer or planer.

Que., Montreal—N. Perron, 221 Christopher Columbus St.—forge, vise, etc., for blacksmith shop.

Que., Montreal—A. Roger, 2660 Fullum St.—planer, etc., for sash and door factory.

Metal Working Shops

Calif., Lankershim—The State Highway Comn., Forum Bldg., Sacramento, is having plans prepared for the construction of an 85 x 150 ft. repair shop, here. R. M. Morton, State Highway Engr.

Conn., Bridgeport — Fletcher-Thompson, Inc., Engrs., 542 Fairfield Ave., receiving bids until Dec. 21 for the construction of a 1 and 2 story, 100 x 298 ft. service station, machine shop and showrooms for the A. L. Clark Co., 1710 Main St., Buick agents. Estimated cost $150,000. Noted May 24.

Fla., Jacksonville—A. Kahn, Archt., 1000 Marquette Bldg., Detroit, will receive bids until Dec. 22 for the construction of a 1 story, 200 x 560 ft. assembly plant on 8th St., here, for the Ford Motor Co., Highland Park (Detroit P. O.) Noted Oct. 25.

Ind., Fort Wayne—The Wayne Oil Tank & Pump Co., Anthony Hotel, awarded the contract for the construction of a 1 story, 80 x 220 ft. addition to its factory for the manufacture of gasoline pumps, etc. Estimated cost $50,000. Noted Dec. 6.

Ind., Michigan City—The Michigan City Lumber & Coal Co. is having plans prepared for the construction of a plant, including garage, on Washington and 2nd Sts. Estimated cost $40,000. Nicol, Scholer & Hoffman, Ross Bldg., Lafayette, Archts.

Ia., Dubuque—The Belsky Motor Co., c/o E. B. Belsky, 6th and Iowa Sts., will receive new bids for the construction of a 2 story, 50 x 125 ft. garage on 8th and Iowa Sts. Estimated cost $50,000. Koenigsberg & Weifeld, 155 Clark St., Chicago, Archts. Former bids rejected.

Neb., Omaha—The Nebraska Power Co., 15th and Farnam Sts., is having preliminary plans prepared for the construction of a 1 story, 114 x 254 ft. machine shop and garage. Estimated cost $150,000. F. S. Scott, 216 Kennedy Bldg., Archt.

N. Y., New York — H. Cahn, c/o J. DeHart, Engr. and Archt., 1041 Fox St., will build a 2 story, 100 x 175 ft. garage on East 69th St. and Ave. A. Estimated cost $200,000.

O., Cleveland—The Acetylene Stove Mfg. Co., 1265 West 2nd St., has had plans prepared for the construction of a 1 story, 60 x 160 ft. factory on East 59th St. and Park Ave. Estimated cost $50,000. W. R. Hopkins, Pres. W. J. Wefel, 3327 Yorkshire Rd., Cleveland Heights, Archt.

O., Cleveland—L. Blanshield, 3322 East 119th St. (automobile radiator repairs) has had plans prepared for the construction of a 1 and 2 story, 43 x 149 ft. garage at 12100 Kinsman Rd. Estimated cost $50,000. L. Skolnik, 6th St. Clair Bldg., Cleveland, Archt.

O., Cleveland—J. Spielman, Ulmer Bldg., has had plans prepared for the construction of a 1 and 2 story, 43 x 129 x 141 ft. garage on East 121st St. and Kinsman Rd. Estimated cost $50,000. Private plans.

O., Steubenville — F. Scott, Studebaker agent, awarded the contract for the construction of a 2 story automobile sales and service building. Estimated cost $150,000. Noted Oct. 25.

Pa., Perkasie — H. Geisel, Sellersville, plans to build a plant for the manufacture of cutlery, here. Estimated cost $25,000.

Pa., Phila.—J. P. Edlert awarded the contract for the construction of a 1 story, 69 x 216 ft. garage on 57th St. and Haddington Ave. Estimated cost $23,000.

Pa., Phila.—The Frankford Grocery Co., Penn and Unity Sts., is having plans prepared for the construction of a 4 story, 64 x 89 ft. warehouse and a 1 story, 45 x 100 ft. garage. Estimated cost $130,000. W. H. Dyer, Land Title Bldg., Phila., Archt.

Pa., Phila.—Packard, Inc., 319 North Broad St., is having plans prepared for the construction of a sales and service station on Broad and Allegheny Sts. P. S. Tyre, 1511 Arch St., archt.

Tenn., Memphis—The Ford Motor Co., Highland Park (Detroit P. O.), is having plans prepared and is receiving bids for steel for the construction of an assembly plant and machine shop on Riverside Blvd., here. Estimated cost $1,000,000. A Kahn, Marquette Bldg., Detroit, Archt. Noted Oct. 4.

Tex., Dallas—The Texas & Pacific R.R., Texas & Pacific Bldg., has had plans prepared for the construction of roundhouse, shops, etc., at Belt Junction. Estimated cost $1,000,000. E. F. Mitchell, Ch. Engr.

Tex., Houston — The Southwestern Bell Telephone Co., Capitol Ave., awarded the contract for the construction of an 8 story shop, etc. Estimated cost $100,000.

Tex., Houston—The White Co., Leeland and La Branch Sts., awarded the contract for the construction of a 1 story, 100 x 100 ft. garage. Estimated cost $40,000. P. E. Seamans, Mgr.

Wash., Seattle — The Ford Motor Co., Highland Park (Detroit P. O.), Mich., is having plans prepared for the construction of a 1 story, 50 x 311 ft. car delivery building on Roy St., here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Wis., Kenosha—The Amer. Brass Co., 570 Elizabeth St., awarded the contract for the construction of a 2 story, 220 x 540 ft. copper wire mill. Estimated cost $300,000. Noted Nov. 1.

Wis., Madison—The Fox Motor Car Co., 107 East Doty St., is having plans prepared for the construction of a 2 story, 72 x 165 ft. garage and repair shop. Estimated cost $50,000. N. W. Fox, Pres. P. M. Homer, Pioneer Block, Archt. Noted Nov. 22.

Wis., Madison—A. J. McCann, 204 Mersey St., is receiving bids for the construction of a 1 story, 60 x 100 ft. garage and repair shop. Estimated cost $50,000. Private plans. Noted Dec. 6.

Wis., Milwaukee—The Curtis Auto Co., 148 8th St., awarded the contract for the construction of a 3 story, 100 x 126 ft. garage on Bway. Estimated cost $200,000.

Wis., Milwaukee—The Main Express Co., 116 Oneida St., awarded the contract for the construction of a 1 story, 60 x 100 ft. garage on Market St. Estimated cost $40,000.